ENERGY REPORT

FINAL 17 March 95

ENERGY ENGINEERING ANALYSIS PROGRAM

ENERGY SURVEY OF ARMY INDUSTRIAL FACILITIES

WESTERN AREA DEMILITARIZATION FACILITY HAWTHORNE ARMY AMMUNITION PLANT HAWTHORNE, NEVADA

VOLUME I

PREPARED FOR

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

PREPARED BY

KELLER & GANNON
ENGINEERS • ARCHITECTS
1453 MISSION STREET, SAN FRANCISCO, CA 94103

CONTRACT NO. DACA05-C-92-0155

DEPARTMENT OF THE ARMY
CONSTRUCTION ENGINEERING RESEARCH LABORATORIES, CORPS OF ENGINEERS
P.O. BOX 9005
CHAMPAIGN, ILLINOIS 61826-9005

REPLY TO
ATTENTION OF: TR-I Library

17 Sep 1997

Based on SOW, these Energy Studies are unclassified/unlimited.
Distribution A. Approved for public release.

Marie Wakefield,
Librarian Engineering

Table of Contents

Volume I

Volume II

List of Figures

List of Tables

1.0 Executive Summary

1.1 Introduction

This report summarizes all work for the Energy Survey of Army Industrial Facilities, Energy Engineering Analysis Program (EEAP) at the Western Area Demilitarization Facility (WADF) of the Hawthorne Army Ammunition Plant (HWAAP), Hawthorne, Nevada, authorized under Contract No. DACA05-92-C-0155 with the U.S. Army Corps of Engineers, Sacramento District, California.

The purpose of this energy survey is to develop a set of projects and actions that will reduce energy consumption and operating costs of selected facilities at the WADF.

A preliminary inspection of facilities at WADF by Keller & Gannon that identified potential retrofit opportunities was submitted as the EEAP Study and Criteria Review in December 1993. This document formed the basis of the Detailed Scope of Work for this study. Facilities included in the survey and study, together with operational status, are listed in Table 1-1. The complete scope of work appears in Appendix A.

1.2 Energy Conservation Analyses

Energy conservation opportunities (ECOs) evaluated are limited to those identified in the EEAP Study and Criteria Review of December 1993. Major areas of investigation included:

- Improvements and repairs to central plant steam generating systems and building heating, ventilating and air conditioning (HVAC) system equipment.
- Building envelope modifications including wall and roof insulation and infiltration controls.
- Building HVAC system control improvements and heat recovery retrofits from process sources and from building exhausts.
- Improvements and repairs to central plant compressed air systems and building compressed air utilizing equipment.
- Modifications to high pressure water pumps serving the steamout building.
- Lighting system fixture and control retrofits.

Energy conservation opportunities recommended for implementation are summarized on Table 1-2. These ECOs all have savings to investment ratios (SIR) above 1.25 and payback periods of 10 years or less. Projects evaluated but not achieving minimum economic criteria are listed on Table 1-3.

1.3 FEMP Project Developed

A Federal Energy Management Program (FEMP) qualifying project covering recommended ECOs in the surveyed facilities is developed. A complete, ready for signature, funding request package is prepared consisting of: DD Form 1391, Detailed Economic Justification and Project Development Brochure, PDB-I.

The FEMP program is selected for the funding request because the Energy Conservation Investment Program (ECIP), for which the project qualifies economically, does not support installation of direct digital control (DDC) systems. The FEMP program, coming from operating and maintenance funds, does not prohibit DDC systems from being selected, providing more freedom of design at the installation level. The funding request package consists of all recommended ECOs shown on Table 1-2, including:

a. Replace all WADF building HVAC system steam condensate return systems including pump and piping repairs.

b. Reduce central plant (Building 117-2) operating steam pressure, install a properly-sized deaerating feedwater preheater and repair steam distribution system leaks.

c. Install oxygen trim combustion controls and flue gas economizer to preheat boiler make-up water on the central steam plant (Building 117-2) package boiler.

d. Replace existing HVAC system pneumatic controls with DDC control systems in all WADF buildings. Retain pneumatic-operated damper and valve actuators.

e. Install air curtains on roll-up doors of WADF Buildings 117-5 and 117-6 (tower structures) to reduce losses of conditioned air.

f. Install run-around type heat recovery systems on WADF Buildings 117-5 and 117-6.

g. Repair insulation on Building 117-5 and 117-6 melt kettles and separation tank steam heating jackets.

h. Replace existing central plant Building 117-2 screw-type air compressors with a modern 2-stage rotary screw-type air compressor system, reusing and renovating existing refrigerated air dryers.

i. Install variable speed drives and modify pump controls on high pressure water pumps located in Building 117-6A which serve the steamout Building 117-6.

j. Modify lighting fixtures as follows:

(1) Delamp and modify 4 two-F40T12 lamp fluorescent lighting fixtures with standard magnetic ballasts to one-F32T8 lamp lighting fixtures with electronic ballasts in WADF Building 117-1.

(2) Delamp and modify 57 four-F40T12 lamp fluorescent lighting fixtures with standard magnetic ballasts to two-F32T8 lamp lighting fixtures with electronic ballasts in WADF Buildings 117-1, 117-3, 117-4, 117-5, 117-6, 117-8 and 117-10.

(3) Retrofit light emitting diode (LEDs) in 81 existing exit sign fixtures located in WADF Buildings 117-1, 117-3, 117-4, 117-5, 117-6, 117-8 and in 117-10.

(4) Delamp and modify 118 four-F40T12 lamp fluorescent lighting fixtures with standard magnetic ballasts to two-F32T8 lamp lighting fixtures with electronic ballasts and specular reflectors in WADF Buildings 117-1, 117-3, 117-4, 117-6, 117-7, 117-8 and 117-10.

(5) Replace 6 existing 100-watt incandescent lamps and bases with DTT-26 compact fluorescent lamps and ballasts in WADF Buildings 117-3, 117-4 and 117-5.

(6) Replace 3 existing 150-watt incandescent lamps and bases with DTT-26 compact fluorescent lamps and ballasts in WADF Buildings 117-3, 117-4 and 117-5.

(7) Retrofit 138 exterior 175-watt mercury vapor lighting fixtures with 50-watt high pressure sodium lamps and ballasts at WADF Buildings 117-1, 117-2, 117-3, 117-4, 117-5, 117-6, 117-6A, 117-7, 117-8, 117-10 and 117-11.

(8) Retrofit 43 existing 400-watt metal halide lighting fixtures with 250-watt high pressure sodium lamps and ballasts at WADF Buildings 117-4, 117-5, 117-6 and 117-7.

The following FEMP project data is taken from the DD Form 1391 life cycle cost analysis summary sheet:

Construction Cost (including SIOH and design costs)	$1,617,064
Annual energy savings	
Electricity	4,003 million BTU
Electric demand	160 kW
No. 2 Fuel Oil	34,460 million BTU
Annual dollar savings	$359,091
Savings-to-investment ratio (SIR)	2.87
Simple payback period	4.50
Analysis date	March 1995

Table 1-1
Western Area Demilitarization Facility, HWAAP
List of Facilities

Building No.	Building Name	Building Area (SF)	Current Operating Status
117-1	Services and Support Building	9,600	Operational
117-2	Boiler Building	13,500	Operational
117-3	Decontamination and Small Items Building	21,650	Operational
117-4	Bulk Explosives Disposal Building	9,085	Non-Operational
117-5	Refining Building	5,060	Operational
117-6	Steamout Building and Addition	5,750 (N) 5,750 (S)	Undergoing Fit-up Operational
117-6A	Pump House	1,000	Operational
117-8	Mechanical Removal Building	8,250	Operational
117-9*	Large Cells Building	3,450	Non-Operational
117-10	Preparation Building	17,100	Non-Operational
117-11	Accumulator Building	2,470	Non-Operational
117-12*	Off-Loading Dock	4,680	Non-Operational
117-13*	Magazines Group A	1,875	Non-Operational
117-14*	Magazines Group B	1,250	Non-Operational
117-15	Flashing Chamber	7,385	Acceptance Testing for TVA Fuel Oil Modification
117-15A*	Antechamber	N/A	Decommissioned

* Denotes buildings not included in the Energy Survey Scope of Work.

Table 1-2. Summary of Analysis Results for Recommended Energy Conservation Opportunities

Description of Energy Conservation Opportunity	Energy Savings: Electric kWH/Yr	Energy Savings: Demand kW	Energy Savings: Fuel Oil Million BTU/Yr	Energy Savings: Energy $/Year	Energy Savings: Energy LCC$	O & M Savings: Savings $/Year	O & M Savings: Savings LCC$	Total Savings: Annual $/Year	Total Savings: Life Cycle LCC$	Retrofit Investment $	Economic Analysis: SIR	Economic Analysis: Payback Years
Central Steam Plant and Distribution System Energy Conservation Opportunities (Refer to Appendix E)												
Replace Building Condensate Return Systems	0	0.0	1,100	$6,743	$95,957	$0	$0	$6,743	$95,957	$64,200	1.49	9.52
Reduce Steam Pressure, Install New Deaerator, and Repair Steam Leaks	0	0.0	21,218	$130,030	$1,850,332	($2,714)	($32,402)	$115,725	$1,687,577	$202,624	8.33	1.75
Install Oxygen Trim Combustion Controls & Flue Economizer	(8,009)	(0.91)	1,435	$8,348	$119,770	($2,501)	($29,856)	$5,847	$89,914	$60,280	1.49	10.31
Subtotal: Central Steam Plant Energy Conservation Opportunities	**(8,009)**	**(0.91)**	**23,753**	**$145,121**	**$2,066,059**	**($5,214)**	**($62,258)**	**$128,315**	**$1,873,447**	**$327,104**	**5.73**	**2.55**
Building Envelope, HVAC System Control and Heat Recovery Energy Conservation Opportunities (Refer to Appendix D)												
Bldgs 117-1,3,4,5,6,8,10&11 HVAC System: Install DDC Controls Retrofits	96,962	60.8	4,779	$39,743	$371,451	$42,079	$358,934	$138,429	$1,296,453	$739,286	1.75	5.34
Bldgs 117-5 & 117-6: Install Air Curtains on Roll-Up Doors	(27,798)	(4.95)	1,218	$5,744	$112,676	($42)	($619)	$5,702	$112,057	$37,777	2.97	6.62
Bldg 117-5 & 117-6: Install Exhaust Air Heat Recovery Run-Around Loop	3,763	(0.28)	3,997	$24,631	$456,924	($2,032)	($30,234)	$22,599	$426,690	$113,461	3.76	5.02
Subtotal: Building HVAC System and Heat Recovery ECOs	**72,927**	**55.6**	**9,994**	**$70,118**	**$941,051**	**$40,006**	**$328,081**	**$166,730**	**$1,835,200**	**$890,524**	**2.06**	**5.34**
Process Equipment Insulation Energy Conservation Opportunities (Refer to Appendix F)												
Repair Building 117-5 & 6 Melt Kettle and Separation Tank Insulation	0	0.00	713	$4,368	$62,164	$0	$0	$3,665	$53,687	$5,907	9.09	1.61
Central Air Compressor System Energy Conservation Opportunities (Refer to Appendix I)												
Replace Existing with SSR 2-Stage Rotary Screw; Use Existing Air Dryers	293,959	59.93	0	$18,987	$286,329	($2,234)	($33,240)	$19,577	$309,560	$166,795	1.86	8.52
High Pressure Water Pump, Steamout Building Annex 117-6A Energy Conservation Opportunities (Refer to Appendix J)												
Install Variable Speed Drive Retrofits on High Pressure Water Pumps	612,442	0.00	0	$26,796	$404,089	$0	$0	$26,796	$404,089	$168,767	2.39	6.30

F:\PROJ\1640316\ENGR\TAB1-23.XLS ECO Sum Table 1-2

Table 1-2. Summary of Analysis Results for Recommended Energy Conservation Opportunities

Description of Energy Conservation Opportunity	Energy Savings: Electric kWH/Yr	Demand kW	Fuel Oil Million BTU/Yr	Energy $/Year	Energy LCC$	O & M Savings: Savings $/Year	Savings LCC$	Total Savings: Annual $/Year	Life Cycle LCC$	Retrofit Investment $	Economic Analysis: SIR	Payback Years
Lighting Fixture and Lighting Control Energy Conservation Opportunities (Refer to Appendix H)												
Lighting Fixture Delamping Retrofits												
LD-1: 2-Lamp F40T12 to 1-Lamp F32T8 with Electronic Ballast	879	0.22	0	$61	$732	$7	$82	$68	$815	$302	2.69	4.46
LD-2: 4-Lamp F40T12 to 2-Lamp F32T8 with Electronic Ballast	22,109	6.33	0	$1,614	$19,400	$196	$2,344	$1,810	$21,745	$5,268	4.13	2.91
Lighting Fixture Retrofits												
LF-1: Retrofit LED Lamp Kit in Existing Exit Lights	12,879	1.47	0	$714	$8,584	($57)	($676)	$658	$7,908	$6,037	1.31	9.18
LF4B: Delamp 4-Lamp F40T12s to 2xF32T8s, Reflector, Electronic Ballast	54,275	13.10	0	$3,713	$44,635	$371	$4,434	$4,085	$49,069	$9,925	4.94	2.43
LF-5: Replace 100W Lamp & Base with DTT-26W Compact Fluorescent	1,366	0.39	0	$100	$1,197	$63	$756	$163	$1,953	$309	6.33	1.90
LF-6: Replace 150W Lamp & Base with DTT-26W Compact Fluorescent	215	0.35	0	$45	$537	$6	$67	$50	$604	$154	3.91	3.07
LF-7: Retrofit Exterior 175W MV Fixture with 50W HPS Lamp & Ballasts	71,129	16.28	0	$4,776	$57,413	($261)	($3,116)	$4,515	$54,297	$24,991	2.17	5.53
LF-8: Retrofit Explosion Proof 400W MH with 250W HPS Lamps & Ballasts	38,818	7.68	0	$2,483	$29,850	$175	$2,084	$2,658	$31,934	$10,980	2.91	4.13
Subtotal, Recommended Lighting Energy Conservation Opportunities	**201,669**	**45.82**	**0**	**$13,507**	**$162,349**	**$501**	**$5,976**	**$14,007**	**$168,325**	**$57,967**	**2.90**	**4.14**
Total Recommended ECOs	**1,172,989**	**160**	**34,460**	**278,898**	**3,922,040**	**33,058**	**238,559**	**359,091**	**4,644,308**	**1,617,064**	**2.87**	**4.50**

Table 1-3. Summary of Analysis Results for Energy Conservation Opportunities Not Recommended

(Energy Conservation Opportunities with SIR's below 1.25)

Description of Energy Conservation Opportunity	Energy Savings: Electric kWH/Yr	Demand kW	Fuel Oil Million BTU/Yr	Energy $/Year	Energy LCC$	O & M Savings: Savings $/Year	Savings LCC$	Total Savings: Annual $/Year	Life Cycle LCC$	Retrofit Investment $	Economic Analysis: SIR	Payback Years
Process Heat Recovery and Insulation Energy Conservation Opportunities (Refer to Appendix F)												
Recover Heat from Rotary Furnace Flues for Building 117-3 Heating	(3,223)	0.00	747	$4,436	$82,870	($922)	($13,725)	$3,514	$69,145	$68,872	1.00	19.60
	Although this ECO shows an SIR of just over 1, the project is not recommended for implementation due to the marginal results.											
Recover Heat from Building 117-4 Incinerator Flues for Space Heating	This project is not evaluated because it is very similar to the process heat recovery project evaluated above. Better economics are not expected.											
Recover Heat from Building 117-15 Flashing Chamber Flue for Heating	This project cannot be installed without performing major process changes. Backpressure from a coil mounted in the flue would unbalance the process, possibly causing noncompliance with EPA pollutant discharge limits. (The units were recently tested for compliance; the system is sensative to changes in flue gas flow adjustments).											
Central Air Compressor System Energy Conservation Opportunities (Refer to Appendix I)												
Replace Air Compressors with Model LL5 Compressors & Desiccant Dryer	257,211	34.21	0	$14,751	$222,442	($3,156)	($46,968)	$16,371	$271,001	$235,684	1.15	14.40
Replace Air Compressors with Model LL5 Compressors; use existing Dryers	257,129	48.00	0	$16,156	$243,632	($3,217)	($47,869)	$15,763	$252,234	$240,202	1.05	15.24
Replace Existing with SSR 2-Stage Rotary Screw and Desiccant Air Dryer	265,330	41.67	0	$15,868	$239,297	($2,448)	($36,422)	$18,197	$298,403	$182,761	1.63	10.04
Building Envelope, HVAC System Control and Heat Recovery Energy Conservation Opportunities (Refer to Appendix D)												
Exhaust Heat Recovery - Single Story Industrial Bldg (117-3 as a Model)	(504)	(0.09)	124	$730	$13,670	($677)	($10,078)	$53	$3,593	$20,901	0.17	394.75
Wall Insulation - Single Story Indstrial Building (117-3 as a Model)	155,142	0.00	875	$528	$9,985	$0	$0	$528	$9,985	$25,081	0.40	2.33
Wall Insulation - Tower Type Indstrial Building (117-5 as a Model)	0	0.00	0	$0	$0	$0	$0	$0	$0	$0	0.00	0.00
High Pressure Water Pump, Steamout Building Annex 117-6A Energy Conservation Opportunities (Refer to Appendix J)												
Replace HP Pump Electric Motors with Internal Combustion Engines	1,352,872	433.61	(6,318)	$64,791	$841,919	($8,237)	($122,564)	$50,075	$622,947	$513,722	1.21	10.26

F:\PROJ\164031\ENGR\TAB1-23.XLS ECO Sum Table 1-3

Table 1-3. Summary of Analysis Results for Energy Conservation Opportunities Not Recommended

(Energy Conservation Opportunities with SIR's below 1.25)

Description of Energy Conservation Opportunity	Energy Savings Electric kWH/Yr	Demand kW	Fuel Oil Million BTU/Yr	Energy $/Year	Energy LCC$	O & M Savings $/Year	O & M Savings LCC$	Total Savings Annual $/Year	Total Savings Life Cycle LCC$	Retrofit Invest-ment $	Economic Analysis SIR	Payback Years
Lighting Fixture and Lighting Control Energy Conservation Opportunities (Refer to Appendix H)												
Lighting Fixture Retrofits												
LF-2: Retrofit Electronic Ballast & 1xF32T8 in 1-Lamp F40T12 Fixture	858	0.49	0	$88	$1,058	($1)	($13)	$87	$1,045	$1,791	0.58	20.60
LF-3A: Retrofit Electronic Ballast & 2xF32T8 in 2-Lamp F40T12 Fixtures	16,592	4.68	0	$1,291	$15,521	($32)	($388)	$1,259	$15,133	$15,144	1.00	12.03
LF-3B: Electronic Ballast & 2xF32T8 Lamps in Industrial 2-Lamp F40T12s	21,890	8.10	0	$1,786	$21,463	($29)	($346)	$1,757	$21,118	$24,973	0.85	14.22
LF-4A: Electronic Ballast & 4xF32T8 Lamps in Existing 4-Lamp F40T12s	24,448	5.90	0	$1,673	$20,106	($36)	($435)	$1,636	$19,671	$18,190	1.08	11.12
ECO LF-4 has two options; option LF-4B, with better economics, is recommended for implementation. See Table 4-1.												
Lighting Control Retrofits												
LC-1: Install Ceiling Mounted Passive Infrared (PIR) Motion Sensors	9,715	0.00	0	$425	$5,109	$0	$0	$425	$5,109	$9,566	0.53	22.51
LC-2: Install Ceiling Mounted Ultrasonic Motion Sensors	2,969	0.00	0	$130	$1,561	$0	$0	$130	$1,561	$6,776	0.23	52.16
LC-3: Replace Wall-Switches with Passive Infrared (PIR) Switches	4,888	0.00	0	$214	$2,571	$0	$0	$214	$2,571	$2,269	1.13	10.61

2.0 Introduction

This interim report contains the results of all work for the Energy Engineering Analysis Program (EEAP), Energy Survey of Army Industrial Facilities at the Western Area Demilitarization Facility (WADF), Hawthorne Army Ammunition Plant (HWAAP), Hawthorne, Nevada. The work was authorized under Contract Number DACA05-92-C-0155 with the U.S. Army Corps of Engineers, Sacramento District, Sacramento, California.

2.1 Purpose

The purpose of this energy survey is to develop a set of projects and actions that will reduce energy consumption and operating costs of selected facilities at the Western Area Demilitarization Facility, HWAAP, Hawthorne, Nevada.

2.2 Scope

The scope of work as established by the U.S. Army Corps of Engineers, Sacramento District, consists of the following tasks:

- Limited site investigation of specific buildings and systems.
- Evaluation of specific energy conservation opportunities (ECOs) to determine economic feasibility.
- Preparation of funding documentation for recommended ECOs.
- Preparation of a comprehensive report documenting the data collected, analyses performed, and projects recommended.

The complete scope of work appears in Appendix A. A preliminary inspection of facilities at WADF by Keller & Gannon that identified potential retrofit opportunities was submitted as the EEAP Study and Criteria Review in December 1993. This document formed the basis of the Detailed Scope of Work for this study. Facilities included in the survey and study, together with operational status, are listed in Table 2-1.

2.3 Methodology

The sequence of the study, in chronological order, progressed from the site investigation to the interim report preparation to the final report preparation. Methodologies used during each phase of the study are addressed as follows:

2.3.1 Site Investigation

An entry briefing attended by the architect/engineer (A/E), representatives of HWAAP Directorate of Engineering and Housing (DEH) and the facility operating contractor, Day & Zimmerman/Basil (DZB), was held prior to beginning the facility inspections. Survey schedules and support requirements from HWAAP DEH and DZB were discussed during this briefing.

Field team members then inspected buildings, lighting systems, HVAC systems, the site steam distribution system and industrial process systems and recorded findings on the standard forms developed by the A/E for this purpose.

Copies of available architectural, mechanical and electrical as-built drawings were obtained for the buildings included in the survey as well as appropriate utility distribution plans and site maps.

An exit briefing was held at the completion of the facility investigations. The purpose of the briefing was to report progress and to report any maintenance needs or "quick fix" measures that could be readily implemented by DEH.

2.3.2 Interim Report

The first step in preparation of the Interim Report was the compilation of building databases for the survey population covering HVAC systems, lighting and building envelope data. Those buildings designated for evaluation of HVAC and insulation retrofits were modeled with the Carrier Hourly Analysis Program (HAP) to develop baseline energy usage and demand load estimates.

Following completion of the building databases and energy modeling, potential ECOs were evaluated for each study building according to the scope of work. Computer modeling, as described above, spreadsheet software and, where necessary, manual calculations were employed to determine the relative benefits of each ECO. Life cycle cost analyses were performed for all ECOs in accordance with the latest "Energy Conservation Investment Program (ECIP) Guidance."

The results of the ECO analyses were summarized into two listings, found in Section 4 of this report, as follows:

(1) All ECOs that were analyzed and recommended, arranged in order of descending savings-to-investment ratio (SIR).

(2) All ECOs that were analyzed and not recommended, arranged in order of descending SIRs.

2.3.3 Final Report

Following the Interim Report presentation and review conference, funding documents will be prepared for combinations of viable ECOs as directed by the Government review. In addition,

revisions resulting from the review conference will be incorporated into these documents. For all projects with savings-to-investment ratios (SIRs) greater than 1.25 and payback periods of 10 years or less, the following funding categories will apply:

- ECIP Project: Construction cost greater than $300,000, simple payback period less than 10 years and SIR equal to or greater than 1.25.

- Federal Energy Management Program (FEMP) and Operations and Maintenance (O&M) energy projects: SIR greater than or equal to 1.25 and simple payback periods of less than 10 years.

- Low Cost/No Cost projects: Projects that HWAAP DEH can perform with in-house resources or by contract.

Table 2-1
Western Area Demilitarization Facility, HWAAP
List of Facilities

Building No.	Building Name	Building Area (SF)	Current Operating Status
117-1	Services and Support Building	9,600	Operational
117-2	Boiler Building	13,500	Operational
117-3	Decontamination and Small Items Building	21,650	Operational
117-4	Bulk Explosives Disposal Building	9,085	Non-Operational
117-5	Refining Building	5,060	Operational
117-6	Steamout Building and Addition	5,750 (N) 5,750 (S)	Undergoing Fitup Operational
117-6A	Pump House	1,000	Operational
117-7	Process Water Treatment Facility	3,320	Operational
117-8	Mechanical Removal Building	8,250	Operational
117-9*	Large Cells Building	3,450	Non-Operational
117-10	Preparation Building	17,100	Non-Operational
117-11	Accumulator Building	2,470	Non-Operational
117-12*	Off-Loading Dock	4,680	Non-Operational
117-13*	Magazines Group A	1,875	Non-Operational
117-14*	Magazines Group B	1,250	Non-Operational
117-15	Flashing Chamber	7,385	Acceptance Testing for TVA Fuel Oil Modification
117-15A*	Antechamber	N/A	Decommissioned

*Denotes buildings not included in the Energy Survey scope of work.

3.0 Description of Installation

3.1 Location, Size and Climate

The Western Area Demilitarization Facility (WADF) is located in Central Nevada, approximately 130 miles southeast of Reno, adjacent to the city of Hawthorne, as shown in Figure 3-1. The installation covers approximately 140 acres at an average elevation of 4,100 feet.

The summer design dry and wet bulb temperatures are 95°F and 64°F, respectively. These are the temperatures equalled or exceeded 2-1/2 percent of the time, on the average, during the warmest four consecutive months (June through September). The dry bulb temperature exceeds 80°F an average of 878 hours per year and the wet bulb temperature exceeds 67°F an average of 9 hours per year during the six warmest months of the year.

The winter design dry bulb temperature is 11°F. This temperature is equalled or exceeded 2 1/2 percent of the time, on the average, during the coldest consecutive three months (December through February). Heating degree days (the difference between the mean daily temperature and a base temperature of 65°F), as listed in TM 5-785, total 5,508 annually.

3.2 Electrical Power and Fuel Oil Supply

The WADF site utilizes electric power, low sulfur No. 2 fuel oil and a small amount of propane fuel. The central plant was originally constructed with three coal fired boilers. However, these 20+ year old boilers have never been fired after their initial acceptance testing and are mothballed. The central steam plant presently utilizes a single No. 2 fuel oil fired steam boiler.

Electrical power is supplied to the Hawthorne Army Ammunition Plant (HWAAP) by Sierra Pacific Power Company at subtransmission voltage level of 60 kV. Capacitor banks for power factor correction installed at the main HWAAP substation maintain the average power factor as measured by Sierra Pacific Power Company at a minimum of 97 percent. A 5,000 kVA, 60 kV - 12.5/7.2 kV transformer is dedicated to the WADF site. Electricity consumption metering, including maximum demand registers, is installed at the main WADF substation and at each of nine distribution transformers. Watthour meter readings are taken weekly at the main WADF meter and weekly, or less frequently depending on the operational status of the facility served, at each of the distribution transformer sub-meters. Historical electricity consumption by month for the total WADF site during FY 1992, FY 1993 and FY 1994 is shown in Figure 3-2.

Low-sulfur No. 2 fuel oil is trucked to the WADF and stored in three 33,000-gallon storage tanks. Historical No. 2 fuel oil consumption for the total WADF site during FY 1992, FY 1993 and FY 1994 is shown in Figure 3-3.

All WADF buildings are provided steam and compressed air service from the central plant, Building 117-2. Steam is used for space heating and for processes. Compressed air is for process needs and as a motive force in heating, ventilating and air conditioning system control components.

All WADF buildings are provided steam and compressed air service from the central plant, Building 117-2. Steam is used for space heating and for processes. Compressed air is for process needs and as a motive force in heating, ventilating and air conditioning system control components.

Energy consumption by WADF facilities currently constitutes about 23 percent of overall HWAAP installation energy usage.

3.3 Demilitarization Facility Description

Cursory descriptions of the industrial processes and major equipment located in each of the WADF buildings included in EEAP energy survey scope are provided in the following paragraphs:

3.3.1 Services and Support Building 117-1

The Services and Support Building houses WADF administrative offices, the wet chemistry laboratory and locker rooms, showers and lunch room for WADF shift workers.

3.3.2 Decontamination and Small Items Building 117-3

This facility is designed to accommodate the final removal of explosives from empty projectile bodies and the detonating of small items of ammunition and weapons parts. The small items are processed in various-sized furnaces served by six cells within the building. Empty projectile bodies are heated to high temperature in the flashing furnace to permit inert certification for disposal of the metal as scrap. A conveyor system moves the projectiles in trays from the loading area to the flashing furnace and onto the roll-over dump where the projectiles are deposited on the skip hoist. The conveyor moves the empty trays to the cooling station and then on to the accumulator area within the work corridor for reloading.

3.3.3 Bulk Explosives Disposal Building 117-4

This facility is designed to receive bulk explosive products, create a slurry, and then dispose of this slurry by incineration. Bulk explosives enter the facility at the upper level where grinding occurs. The ground explosive is then transferred to the lower level where water is introduced and a slurry is created by two agitators. The slurry is pumped into one of two fuel-oil-fired incinerators, fitted with afterburners, for final disposal. Currently, this facility is not in operation.

3.3.4 Refining Building 117-5

This facility is designed to remove explosives from projectile bodies and convert the explosives to a form suitable for storage or shipment. In the meltout autoclave, steam and water are used to clean explosives out of projectile bodies. The explosive-water mixture is further refined in meltout kettles and then cooled into solid chunks by the belt flaker.

3.3.5 Steamout Building and Addition 117-6

This facility is designed to remove explosives from larger projectiles and process the explosives to a form suitable for storage or shipment. Major equipment located in the North Tower includes four steamout autoclaves, a separation tank, two melt kettles and a belt flaker. Major equipment located in the South Tower (Addition) include a washout turntable, a washout chamber and a filter press for extracting water from the explosive-water mixture. High pressure water is delivered to the high pressure water lances at the washout turntable from the Pump House Building 117-6A.

3.3.6 Pump House Building 117-6A

This facility contains five 150 HP motor-driven high-pressure water pumps that supply 13,000 psig to Building 117-6 South Tower.

3.3.7 Process Water Treatment Facility 117-7

This facility is designed to receive process wastewater from WADF buildings, treat the wastewater with chemicals and filtration, and deliver treated recycled process water back to the industrial facilities. Excess treated effluent is drained to evaporation ponds for disposal.

3.3.8 Mechanical Removal Building 117-8

This facility contains hydraulically-operated equipment located in three cells for sawing, drilling and punching projectiles to remove components prior to processing in the Refining or Steamout buildings.

3.3.9 Preparation Building 117-10

This facility was designed to defuse projectiles and remove smokeless powder from ammunition. Currently, this building is not in operation.

3.3.10 Accumulator Building 117-11

This facility was designed to collect smokeless powder from the Preparation Building and pack it for storage or shipment. Currently, this building is not in operation.

3.3.11 Flashing Chamber Building 117-15

This facility is designed for the incineration of non-recyclable explosive materials. Acceptance testing by the Tennessee Valley Authority (TVA) for a fuel oil modification is currently underway.

3.4 Central Steam and Compressed Air Plant Building 117-2

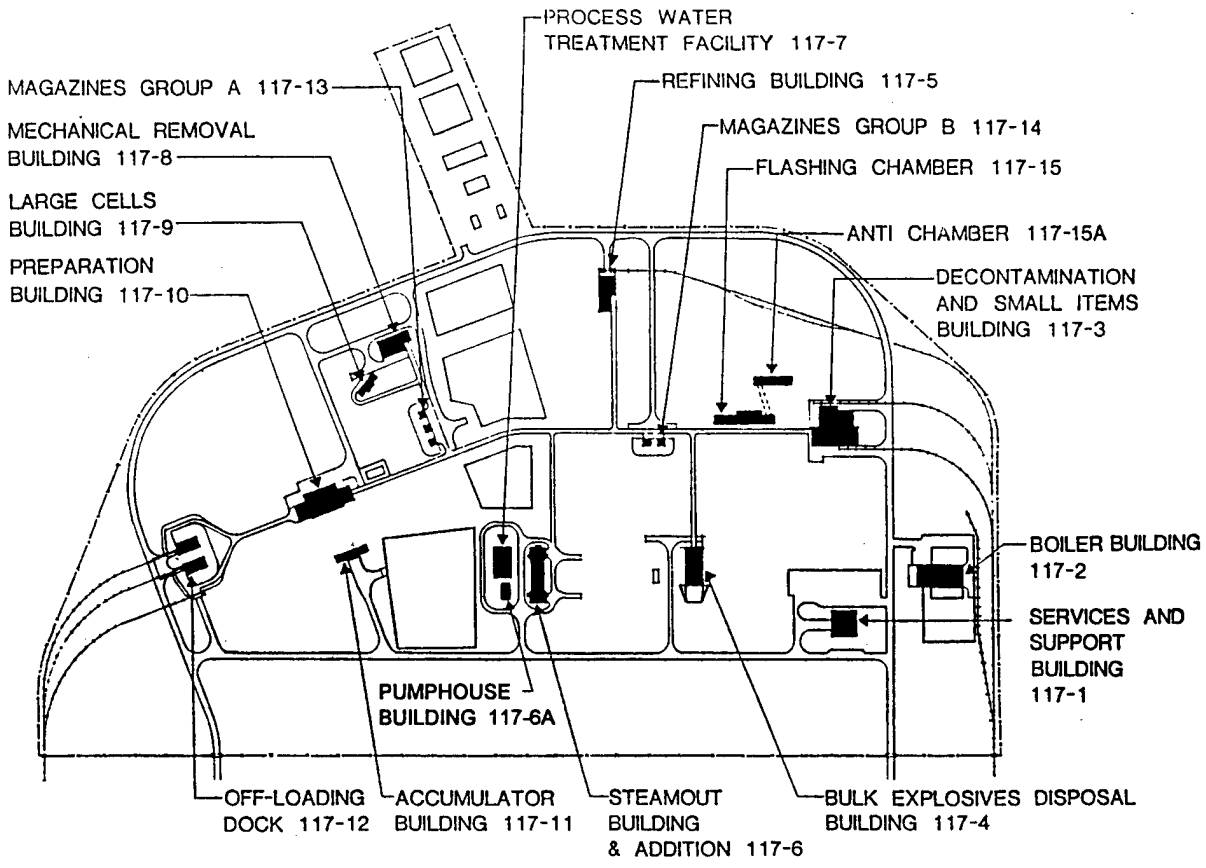
Building 117-2 houses the central steam plant serving WADF facilities. The steam plant was originally designed and constructed for the purpose of providing steam to all of the Hawthorne Ammunition Plant. Due to changes in the mission and transfer from the U.S. Navy to the U.S. Army, complicated by inactivation for a number of years, the three Keeler 50,000 pound per hour (PPH) steam boilers have never been operated after their initial acceptance testing. They have been, and remain, "mothballed."

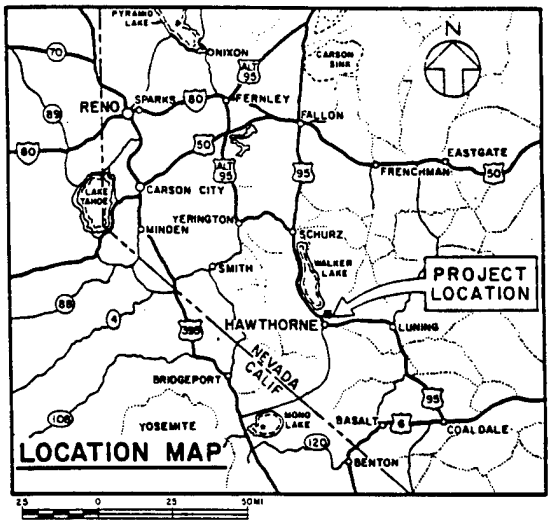
When the WADF was placed into operation several years ago, a packaged Cleaver-Brooks 17,000 PPH fire tube boiler was installed in the boiler plant to provide steam service only to WADF facilities. The boiler is located in the service bay at the Northwest corner of the building and utilizes the deaerating feedwater heater and other ancillary equipment originally installed to serve the three 50,000 PPH coal-fired steam boilers. Steam is distributed through surface and underground piping to most WADF buildings for space heating and process uses. The central steam plant and distribution system is shown schematically in Figure 3-4.

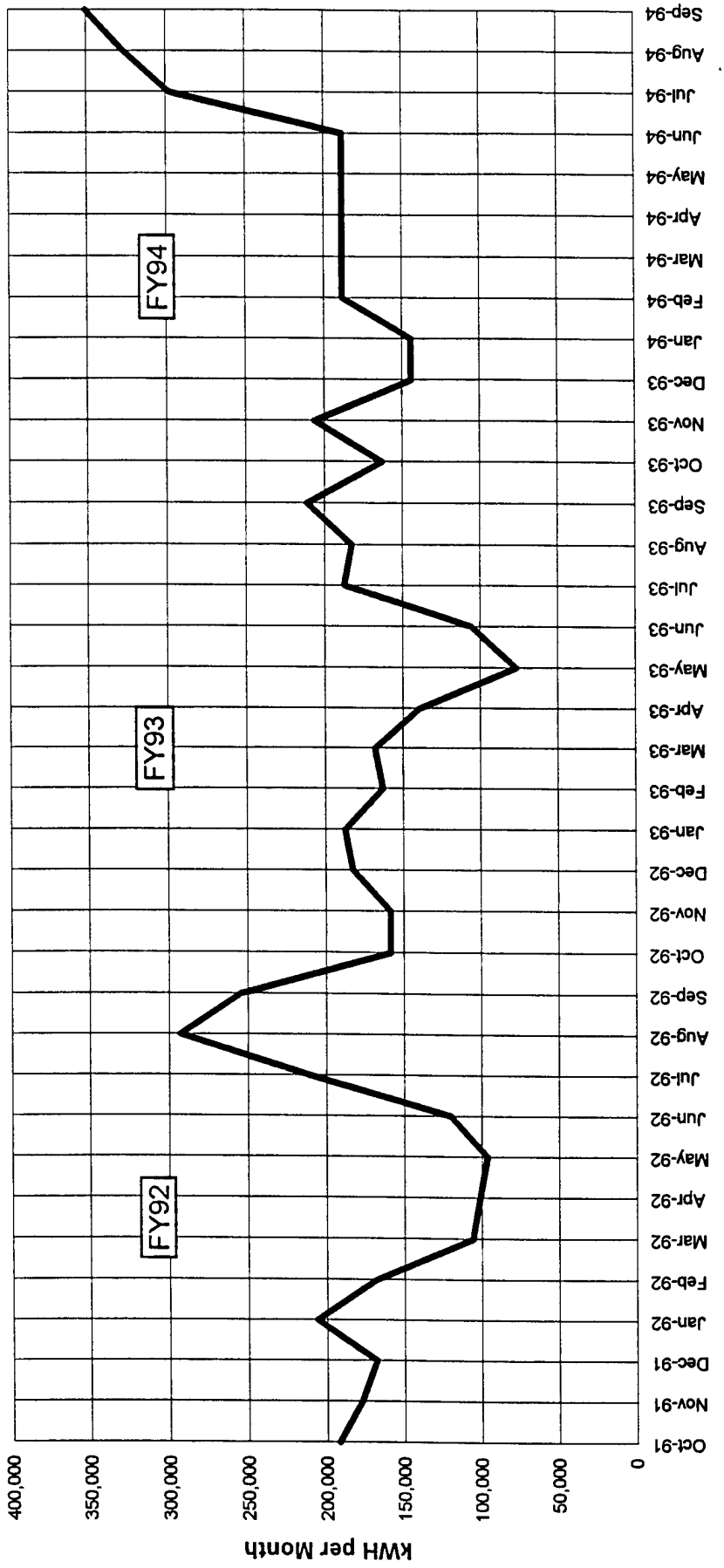
Compressed air is also produced in Building 117-2; central plant equipment and the distribution system are all shown schematically on Figure 3-5.

Figure 3-1

Western Area Demilitarization Facility
Site Plan and Location Map



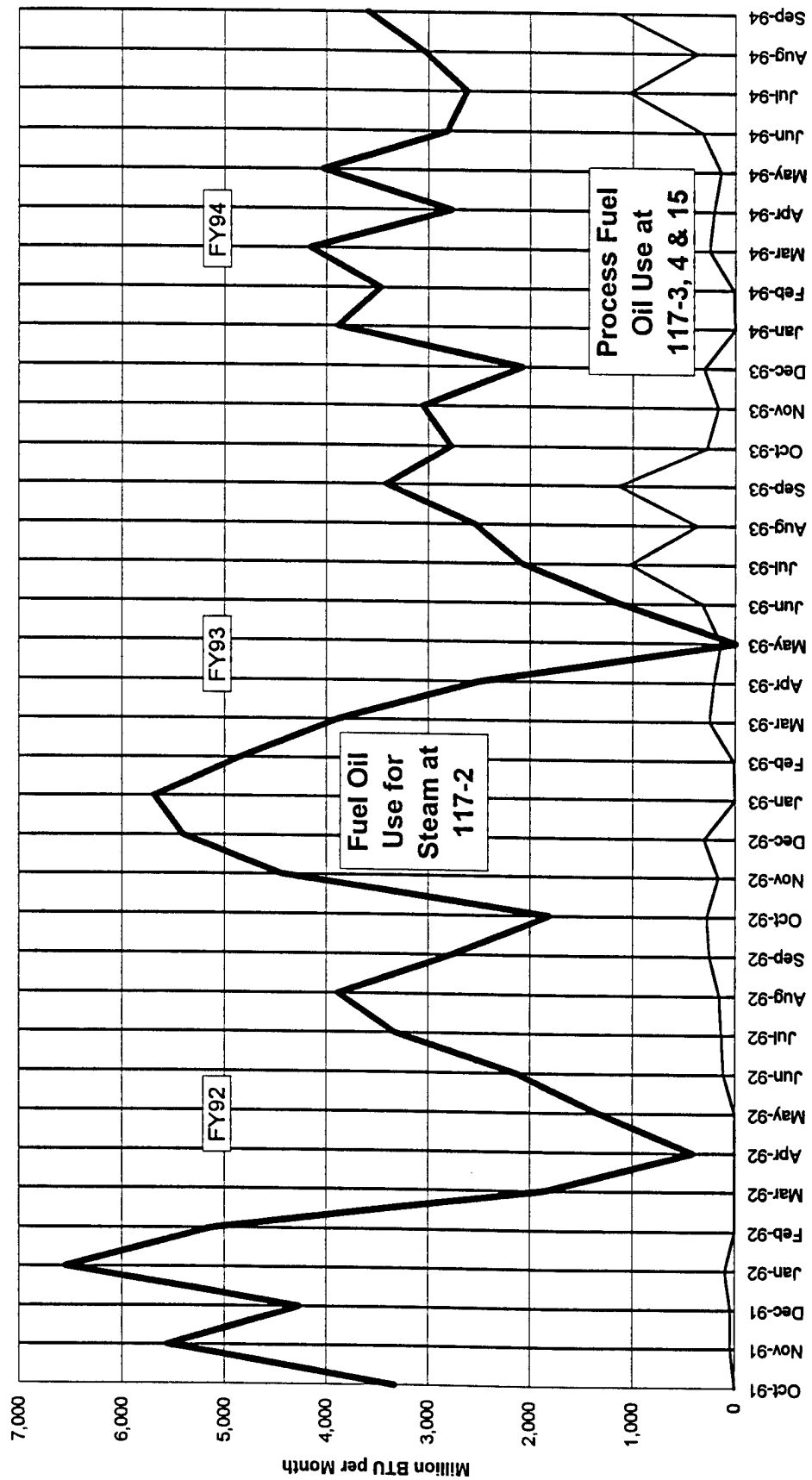




F:\PROJ\1640316\ENGR* Sheet1 Chart 3

Figure 3-2.
Western Area Demilitarization Facility
Historical Monthly Electricity Consumption:
FY92 through FY94

Note: No meter readings taken in Dec-93, Feb-94, Mar-94, Apr-94 and May-94.



F:\PROJ\1640316\ENGR* Figure 3-3 Chart 1

Figure 3-3.
Western Area Demilitarization Facility
Historical No. 2 Fuel Oil Consumption:
FY92 through FY94

Figure 3-4

Western Area Demilitarization Facility
Steam Distribution System Schematic Diagram

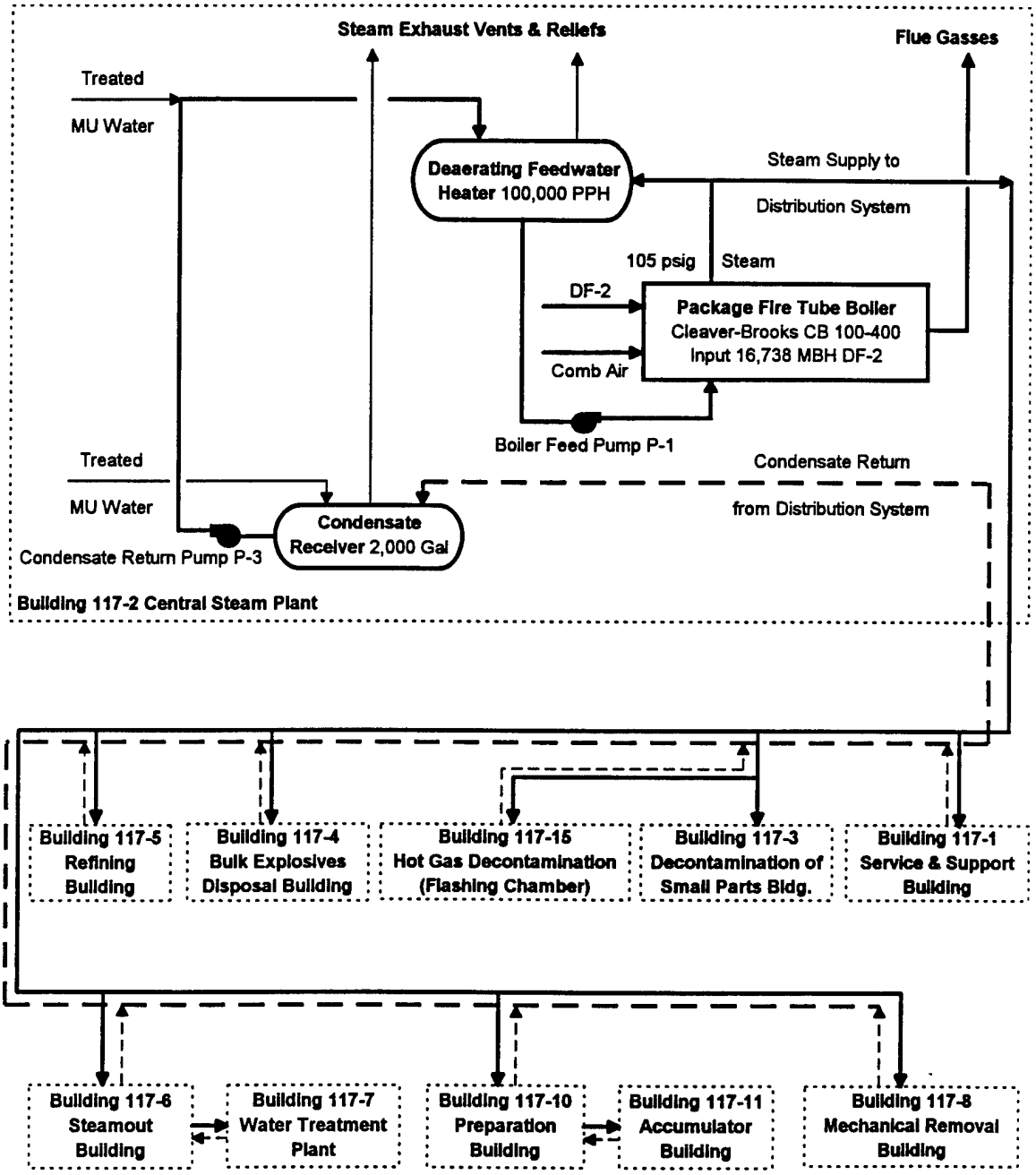
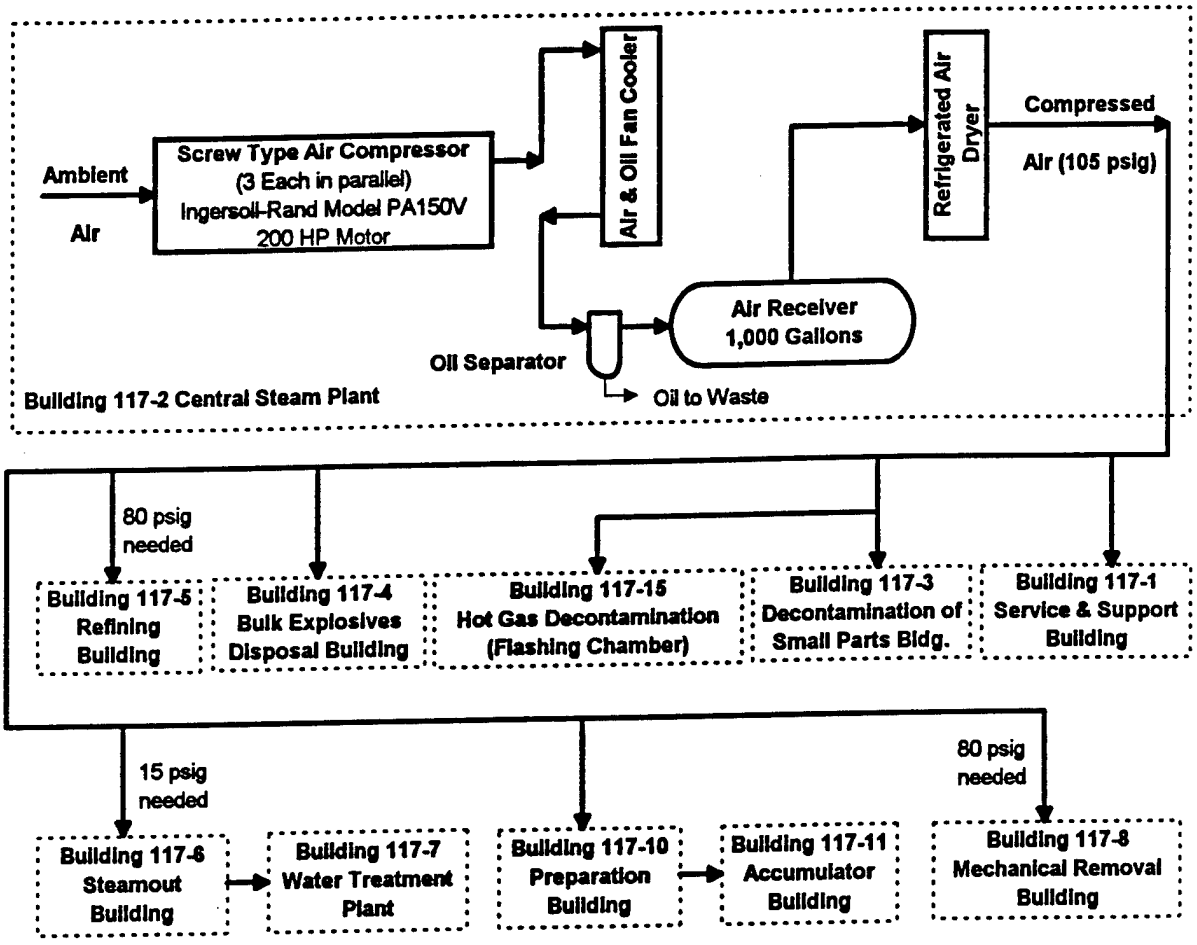


Figure 3-5
Western Area Demilitarization Facility
Compressed Air Distribution System Schematic Diagram



4.0 Energy Conservation Evaluations

4.1 Life Cycle Cost Analysis Assumptions

4.1.1 Economic Assumptions

Economic analyses based on present value techniques were performed for all potential energy conservation opportunities using the economic analysis form and procedures outlined in "Energy Conservation Investment Program (ECIP) Guidance" dated January 1994. The following assumptions and methods were used to develop standard input for economic analysis of all projects:

a. Investment costs include the following: Construction costs; contingency estimated at 10% of construction costs; supervision, inspection and overhead (SIOH) at 6% of construction costs; and design at 6% of construction costs. To compute total investment, the sum of the above costs was reduced by the amount of the expected utility rebate, if applicable.

b. The economic analysis was performed based on current (first quarter FY95) costs.

c. Discount factors and uniform present value factors used in computing present values are obtained from the supplement to NIST Handbook 135, "Energy Prices and Discount Factors for Life-Cycle Cost Analysis 1995." The discount rate set for 1995 by the Dept. of Energy is equivalent to a market rate of 6.6%. Allowing for an assumed rate of general price inflation yields a "real" discount rate lower than the 3.0 percent floor prescribed in 10 CFR 436. Thus, the 3.0 percent floor is used as the real discount rate for FY 1995 analyses. Uniform present value factors (designated UPV*) using the 3.0% discount rate and adjusted for average fuel price escalation in the industrial sector for Census Region 4 are used in the analyses below.

d. The present value of recurring non-energy benefits and costs was obtained using a 0% differential rate and a 3.0% discount rate.

4.1.2 Energy Cost Assumptions

4.1.2.1 Electricity

Electric power is provided to the HWAAP by Sierra Pacific Power Company under "Schedule E93 Resale Service," which includes a demand charge with ratcheting provision, an energy charge and an adjustment for power factor. Current rates—including the effect of the projected fuel adjustment and power factor discount used in the analyses—are as follows:

Demand Charge = $8.51713 per kW per month ($102.21 per kW per year)

Where billing demand kW is the highest measured demand occurring during the month, with a minimum of 50 percent of the highest billing demand in the previous eleven months.

Energy Charge = $0.04375 per kWH ($12.82 per million BTUs)

Power Factor Discount (or Surcharge) =
(Average Power Factor in Percent - 80) x 0.15% x (Demand Charge + Energy Charge)

Copies of current Sierra Pacific Power Company rate schedules appear in Appendix B.

4.1.2.2 No. 2 Fuel Oil

The current cost of No. 2 fuel oil delivered to the WADF site is $0.85 per gallon ($6.13 per million BTUs).

4.2 Construction Cost Estimate Methodology

Construction costs are estimated for each energy conservation opportunity evaluated. Cost estimates are prepared to the level of accuracy required to assess project economic viability and may be considered budget-level cost estimates. Labor and material costs are based predominantly on the 1994 Means Cost Estimating Guides with adjustments for geographic location and difficulty of retrofit work, as appropriate. Whenever feasible, budget quotes from equipment manufacturers have been used to improve accuracy.

Factors added to the subtotal of labor and materials costs include:

- Nevada State Sales Tax at 3.75% (added to materials cost only)
- Contractor Overhead and Profit at 25%
- Bond at 1.5%
- Estimating Contingency at 10%

The resulting total probable construction costs are subsequently used in life cycle cost analyses.

4.3 Utility Rebate Programs

Sierra Pacific Power Company, the electric utility serving HWAAP, suspended all energy conservation retrofit rebate programs in September of 1994.

4.4 Simulated Baseline Energy Consumption

A reliable historical baseline for fuel oil consumption cannot be established from the few years of WADF operations because building HVAC systems in most of the buildings have not been functioning properly, the operating schedule of WADF has been highly variable, some process

systems have been under renovation and several buildings included in the study scope are not operational. In fact, buildings containing 55 percent of the total WADF floor area are currently non-operational.

Projections of future energy savings developed in this study are based on the assumption that all WADF buildings included in the scope will be fully operational. Consequently, a simulated energy consumption baseline for No. 2 fuel oil and electric power was developed. The baseline energy consumption estimates are summarized in Table 4-1.

Refer to Appendix C for data supporting the simulated baseline energy consumption estimate.

4.5 Energy Conservation Opportunities Studied

ECOs evaluated in this study are briefly described in the following paragraphs.

4.5.1 Building Envelope Modifications

4.5.1.1 Building Insulation Retrofits

During field investigations, it was discovered that all non-industrial building areas are already insulated. Insulation includes rigid roof insulation and fiberglass type wall insulation. Industrial type processing areas are not presently insulated. Analysis indicates that it is not economic to retrofit insulation in these buildings now. See Appendix D for calculations.

4.5.1.2 Air Curtain Retrofits

Large doors in most of the WADF industrial facilities must stay open during most of the scheduled operating hours to accommodate movement of materials from one building to another. Conditioned air is lost through the open roll-up doors.

Plastic strip curtains were installed on several openings some years ago in an attempt to eliminate infiltration from open doors. While strip curtains are often effective in similar warehousing operations, they have proved ineffective at WADF because they have become contaminated (discolored) with explosives and have created a hazard to forklift operators moving munitions. The hazard is two-fold: (1) visibility is limited due to discoloration caused by contact with explosives particulates and sunlight; and (2) the heavy strips hit the forklift operators when they execute turns close to the doorways. In at least one case, a load of munitions was spilled.

Installation of air curtains will perform the same function as plastic strip curtains without the hazards. A continuous, high velocity stream of air is directed from the top to bottom of door openings via special fans. The disadvantage is that power is consumed by the fans. Energy savings from reduced losses of conditioned air is balanced against increased fan electrical energy consumption.

Refer to Appendix D for analysis and calculations of air curtain installation on roll-up doors.

4.5.2 HVAC System Retrofits

4.5.2.1 Direct Digital Controls (DDC) Retrofits

All WADF building HVAC systems currently have pneumatic controls. While pneumatic process controls are calibrated periodically, building HVAC system controls, for the most part, are not, due to limited maintenance staffing. In addition to uncalibrated controls, several HVAC systems require repairs before they can be operated as designed.

Energy savings are achievable by installing DDC controls to replace existing pneumatic controls. Some of the features that DDC controls can provide include:

- Heating and cooling supply air temperature reset,
- Proper space temperature control, and
- Night and weekend (scheduled down time) temperature set-back controls.

Energy savings were estimated using Carrier Corporation's Hourly Analysis Program (HAP-30), a computerized HVAC energy use simulation program.

Three representative WADF buildings were modeled; results of these simulations were extended to other WADF buildings on a floor area basis separately for each functional area. Separate simulations are provided for each functional area of the "model" buildings, including:

- Control rooms/office areas (often including toilets and break rooms),
- Work/processing areas, e.g., "towers" in Buildings 117-5 and 117-6, and
- Mechanical rooms

All control components placed into workroom environments where explosives are present must be of explosion-proof construction. Since most of these components are sensors, this is not viewed as a significant design problem. Refer to Appendix D for analysis and calculations of DDC retrofits for all study building HVAC systems.

DDC controls upgrads are considered repair projects. Since they do not constitute new construction or a major renovation, the design requirements of AR 420-10 do not apply. Funding must be applied for through operation and maintenance (O&M) funding sources such as the FEMP program because DDC controls are not allowed in MCA funded projects such as the ECIP program. (These findings and funding recommendations are based on discussions with experts at the Mobile and Savannah Corps of Engineer Districts, Centers of Technical Excellence for Energy Conservation and HVAC Controls, respectively.)

4.5.2.2 Exhaust Air Heat Recovery

Building exhausts contain conditioned air. Heat contained in this exhausted air can be recovered for reuse in conditioning fresh outside air introduced into the buildings.

Of three potential methods for recovering thermal energy from air streams—heat pipes, thermal wheels, and run-around loops—only run-around loops are suitable for application on WADF HVAC systems. To implement this retrofit, heat transfer coils are installed at both work area exhaust and fresh air intakes. Water or an ethylene glycol - water mixture is pumped around the loop, from one coil to another, transferring heat from one air stream to the other. The advantages of this arrangement include non-contamination and the flexibility of serving air streams that may not be located close together. The disadvantage is that the system requires a pump, reducing the amount of energy that may be recovered due to pumping energy requirements. Energy savings were determined using the computer HVAC energy use simulation program HAP-30.

Refer to Appendix D for analysis of run-around loop installations at the three buildings considered suitable for this retrofit: 117-5, 117-6 North, and 117-6 South.

4.5.3 Central Steam Plant and Steam Distribution System Retrofits

4.5.3.1 HVAC Steam Condensate Return System Replacement

Inoperative equipment in the HVAC steam condensate return system has resulted in fuel oil consumption for space heating to be higher than necessary. Savings estimates for this ECO were based on building heating energy usage estimated using the Carrier Corporation HAP-30 simulation program. Refer to Appendix E for the analysis and calculations.

4.5.3.2 Steam Distribution System Leak Repairs, Pressure Reduction and Properly-Sized Deaerator Installation

By far, the greatest energy savings in operation of the steam distribution system can be achieved by replacing seriously-leaking components throughout the distribution system, including ball-expansion joints and control valves. Additional savings may be achieved by reducing the steam boiler plant pressure to the minimum necessary to serve space heating loads (40 psig) and process loads (15 psig). The existing deaerating feedwater heater was sized to accommodate three 50,000 pound per hour (PPH) coal-fired boilers, whereas the packaged fuel-oil-fired boiler in use can generate only about 13,400 PPH of steam. Replacing the oversized deaerating feedwater heater with a properly-sized unit will save additional energy.

Refer to Appendix E for data, analyses and calculations of the above ECOs.

4.5.3.3 Oxygen Trim Control and Boiler Flue Economizer Retrofits

Field measurements of Building 117-2 Cleaver-Brooks steam boiler flue gases indicated a high oxygen content. Retrofitting the boiler with automatic oxygen trim combustion controls will

limit the oxygen content, increase flue gas temperature and improve combustion efficiency by almost two percent.

Installation of a flue stack economizer to recover heat from flue gases to preheat cold makeup water will improve the steam plant efficiency by an estimated 6.7 percent.

Refer to Appendix E for data, calculations and analyses of the above ECOs.

4.5.4 Process Heat Recovery and Insulation Repair Retrofits

Several processes at WADF involve high temperature processing of explosive materials and munitions components. Heat recovery from these processes for space heating purposes was evaluated. These facilities include:

- Building 117-3 Small Items Decontamination Facility
  - Lead Items Rotary Furnace System (1 Each)
  - Detonating Items Rotary Furnace System (mothballed, 1 Each)
  - Small Items Flashing Furnace System (1 Each)
- Building 117-4 Bulk Explosives Disposal Facility
  - Bulk Explosives Slurry Incinerator System
- Building 117-15 Flashing Chamber
  - High temperature "burn-out" of small items contaminated by explosives

Processing buildings 117-5 and 117-6 utilize steam to assist in the removal of explosives from various munitions. Melt kettles installed in both buildings and a separation tank located in Building 117-6 are semi-spherical steam-jacketed vessels. Since non-asbestos-containing insulation applied to the exterior of these vessels has fallen off, insulation repairs are evaluated.

4.5.4.1 Heat Recovery from Processes in Building 117-3

Each of the processes in the Small Items Decontamination Building involves exposing explosives contaminated components to high temperatures to combust any residual explosive materials, quenching (cooling) in a water bath and transferring to storage for metals recycling.

Heat recovery is possible from high temperature breaching between rotary furnaces and cyclone separators (the first step in the air pollution control equipment). Custom designed heat exchangers can be fabricated to remove some of the heat from the flue exteriors without intrusive modifications into process equipment. Such heat exchangers would consist of concentric flue pipe sections, flooded with heat transfer fluid.

The heat recovery concept is to recover sufficient heat to displace the need for steam required for space heating purposes. Heating fluid (Dowtherm or a similar liquid) is pumped between the heat exchanger placed on rotary furnace breaching and a heat exchanger to be placed upstream of the steam to ethylene-glycol heat exchanger in the mechanical room. The system would be sized to recover 100 percent of the space heat needed and would displace the need for steam heating whenever the rotary furnaces are operating. Since it is unlikely that all three rotary furnaces would operate simultaneously, three heat exchangers would be needed, each with the capacity to recover 50 percent of the space heating load.

Since analysis of this heat recovery retrofit yielded a marginal SIR and an almost 20-year payback period, this measure is not recommended. Refer to Appendix F for analysis and calculations.

4.5.4.2 Heat Recovery from Processes in Building 117-4

Building 117-4, Bulk Disposal Building, houses processing equipment for incinerating a slurry of explosives in two incinerators. Sections of the incinerator (kiln) breaching could be fitted with heat exchangers similar to those proposed for Building 117-3 in the above discussion. The type of installation, heat loads and expected energy recovery are expected to be proportional to those developed for Building 117-3; thus, heat recovery without contacting the flue gases directly is ruled out as a viable option. Furthermore, it is unlikely that incinerator runs will be coincident with the need for space heating in the building. Thus, no further analysis of heat recovery from Building 117-4 incinerators was conducted.

4.5.4.3 Heat Recovery from Processes in Building 177-15

Building 117-3, Flashing Chamber, contains a large chamber that is heated to high temperature for extended periods. The system has recently undergone an extensive modification of combustion controls and optimization by the Tennessee Valley Authority (TVA) for certification by the Environmental Protection Agency (EPA). EPA compliance testing for atmospheric emissions is currently underway (December 1994) and is expected to be successful. Presuming that the facility will be given permission to operate, the present 55-inch diameter exhaust stack will discharge about 2,000 SCFM at between 1,750°F and 1,850°F.

Heat can be recovered from the exhaust gases by the installation of a heat reclamation coil at the top of the exhaust stack; however, a static pressure regain section must be provided to overcome the additional back pressure on the exhaust fans. Based on current operating conditions, there is not sufficient velocity pressure available to allow a regain flue section to overcome the pressure drop across a coil. In order to provide any heat recovery, then, the existing fan systems serving the Flashing Chamber will have to be retuned to overcome the coil pressure drop.

The operating system at the Flashing Chamber is extremely sensitive. Based on discussions with TVA personnel who have recently modified the process for proper operation and for compliance with the EPA's atmospheric discharge requirements, a great deal of effort would

be required to rebalance the system again, possibly requiring several man-months of effort of highly compensated experts.

Modifications to recover heat from the Flashing Chamber operations are, thus, not recommended. Refer to Appendix F for analysis and calculations.

4.5.4.4 Melt Kettle and Separation Tank Insulation Repairs

Insulation is falling off the sides and bottoms of four melt kettles located in Buildings 117-5 and 117-6 and the separation tank located in Building 117-6.

A measure to install insulation tabs to the vessels, replace the existing insulation and periodically replace insulation every five years (due to exposure to steam) was evaluated and found to be highly beneficial.

Refer to Appendix F for analysis and calculations.

4.5.5 Lighting Fixture and Control Retrofits

Three types of energy saving retrofits are evaluated for study buildings:

- Lighting fixture delamping, plus lamp and ballast modifications,
- Lighting fixture lamp, ballast and reflector modifications, and
- Lighting controls modifications

The following specific measures were evaluated for each type of retrofit:

Lighting ECO Number	Description
LD-1	Delamp and Retrofit from 2-Lamp F40T12 Fixture to a 1-Lamp F32T8 Fixture with Electronic Ballast
LD-2	Delamp and Retrofit from 4-Lamp F40T12 Fixture to a 2-Lamp F32T8 Fixture with Electronic Ballast
LF-1	Retrofit LED Lamp Kit in Existing Exit Lights
LF-2	Retrofit Electronic Ballast & 1xF32T8 Lamp in Existing 1-Lamp F40T12 Fixtures
LF-3A	Retrofit Electronic Ballast & 2xF32T8 Lamps in Existing Standard 2-Lamp F40T12 Fixtures
LF-3B	Retrofit Electronic Ballast & 2xF32T8 Lamps in Existing Industrial 2-Lamp F40T12 Fixtures
LF-4A	Retrofit Electronic Ballast & 4xF32T8 Lamps in Existing 4-Lamp F40T12 Fixtures, or
LF-4B	Delamp to 2xF32T8 Lamps & Install Reflector & Electronic Ballast in 4-Lamp F40T12 Fixtures
LF-5	Replace 100W Incandescent Lamp and Socket with DTT-26W, 2700K, CRI 82 Compact Fluorescent Lamp and Ballast
LF-6	Replace 150W Incandescent Lamp and Socket with DTT-26W, 2700K, CRI 80 Compact Fluorescent Lamp and Ballast

Lighting ECO Number	Description
LF-7	Retrofit Existing 175W Mercury Vapor (MV) Exterior Fixtures with 50W High Pressure Sodium (HPS) Lamps & Ballasts
LF-8	Retrofit Existing 400W Metal Halide Explosion-Proof Fixtures with 250W HPS Lamps & Ballasts
LC-1	Lighting Control Retrofit: Install Ceiling-Mounted Passive Infrared (PIR) Motion Sensors
LC-2	Lighting Control Retrofit: Install Ceiling-Mounted Ultrasonic Motion Sensors
LC-3	Lighting Control Retrofit: Replace Wall Switches with Passive Infrared (PIR) Motion Sensor Switches

Refer to Appendix G for lighting system data, calculation methodology, and building lighting energy usage and demand baseline estimates.

Refer to Appendix H for lighting and controls retrofit analyses, including room-by-room calculations of energy and demand savings resulting from the proposed fixture modifications.

4.5.6 Compressed Air System Modifications

Compressed air is distributed to WADF buildings at about 105 psig from the central plant, Building 117-2. "Plant air" is used for process applications as well as the motive force for damper actuators in HVAC systems. Three Ingersoll-Rand Model PA150 screw type air compressors are connected in parallel, with two operating units and one spare unit. A single compressor supplies the existing load; however, most WADF buildings are not presently operating. Therefore, evaluations of compressed air system modifications consider providing a capacity equal to the original installation.

In most mechanical rooms, plant air and instrument air systems have been interconnected. This was done to retain control in the event of a central plant shutdown; however, interconnections have remained open. This has led to contamination of sensors and controls which are not designed for even the small amounts of oil found in plant air. HVAC control system retrofit calculations provided in Appendix D assume replacement of existing pneumatic control systems with DDC controls, effectively eliminating the need for instrument compressed air service. Plant air is still required to provide motive force for damper actuators and other control devices.

The existing air compressors require rebuilding due, in part, to an extended period of inactivity. Currently, two of the three air compressors are partially disassembled and undergoing repairs. It is assumed that all three existing compressors require "air-end" rebuilds and control system modifications. Accordingly, in the evaluations of proposed equipment replacements, the cost of such renovation and repair was considered to be an avoided expense.

The largest compressed air load to the system is leaking equipment, including an oil separator in Building 117-6 and a conveyor hopper air valve in Building 117-11.

Four alternatives for modifying the central plant compressed air system were evaluated. In each case, backup compressed air service to allow for safe shutdown in the event of a compressor loss is assumed to be available from existing instrument air compressors located in each WADF building mechanical room. Alternatives considered include:

1. Replace the existing Model PA150 screw type air compressors and refrigerated air dryers with a single Model SSR XFE300-2S, 300 HP, two-stage rotary-screw air compressor and desiccant air dryer: The desiccant air dryer consumes about 15 percent of the proposed compressor's output to regenerate desiccant. The existing load is still met due to the greater efficiency of the proposed compressor. The proposed rotary-screw air compressor is air cooled; thus, costs of ducting outside air into and out of the compressor are included in the life cycle cost analysis.

2. Replace three existing Model PA150 screw type air compressors with a single Model SSR XFE250-2S, 250 HP, two-stage rotary-screw air compressor and repair existing refrigerated air dryers: This alternative is similar to option 1, except the existing refrigerated air dryers are retained in service. A smaller capacity compressor meets the existing load, since the desiccant air dryer load is not imposed on the system.

3. Replace three existing Model PA150 screw type air compressors and refrigerated air dryers with two Model LL5, 150 HP, water-cooled reciprocating air compressors and desiccant air dryers: Since the desiccant air dryer requires about 15 percent of the compressed air produced, the proposed compressors are oversized to allow for desiccant regeneration. As the proposed compressors are water cooled, cost of a new cooling water system is included in the investment.

4. Replace three existing Model PA150 screw type air compressors with two Model LL5, 125 HP, reciprocating air compressors and repair existing refrigerated air dryers: This alternative is similar to option 3, except that the existing refrigerated air dryers are retained in service. Smaller capacity compressors meet the existing load, since the desiccant air dryer load is not imposed on the system.

Alternative 2 was found to be the best choice based on economic analyses. Refer to Appendix I for these analyses and calculations.

4.5.7 High Pressure Water Pump System Retrofits

The high pressure water pump system is housed in Building 117-6A, next to the Steamout Building. Five high pressure water pumps driven by 150 HP induction motors serve operations in the Steamout Building. The pumps provide water at about 13,000 psig to washout lances at the washout-steamout tables in Building 117-6. Four of the five pumps are normally operated, with one as a spare.

The pumps are positive displacement pumps and are energized whenever the hydraulic cleaning equipment in the South Tower is operated: about 10 hours a day, 6 days per week.

In order to maintain continuous high pressure water service to the washout lances, the pump discharges are recirculated to pump suctions. This requires all energized pumps to operate at peak load continuously.

4.5.7.1 Install Variable Frequency Drives to Control High Pressure Water Pump Speeds

This retrofit will provide variable pump speed control, responding to demand at the washout lances. Variable speed control of the high pressure water pumps will reduce energy consumption, causing the pumps to operate at full load only when required, and will modulate pump speed under lower loads to only that speed needed to maintain water pressure.

Refer to Appendix J for analysis and calculations.

4.5.7.2 Replace Electric Motors on High Pressure Water Pumps With Internal Combustion Engines

Substituting internal combustion engine drives for the existing 150 HP electric motors that power the high pressure water pumps will result in electrical demand, as well as usage, savings. Additional savings will result from energizing only the number of pumps necessary to meet water demand during reduced-load conditions. Electrical demand and consumption savings will be offset partially by increased No. 2 fuel oil consumption and the greater maintenance required by the diesel engines. To minimize disruption to existing WADF operations, a new pump building, in addition to underground fuel oil storage, will be provided as part of the project.

Refer to Appendix J for analysis and calculations.

4.6 Recommended Energy Conservation Projects

A summary of overall analysis results for recommended ECOs, with projects grouped by retrofit category, appears in Table 4-2; and a summary of analysis results for ECOs not recommended appears in Table 4-3.

4.7 Recommended Operations and Maintenance Changes

During field investigations conducted for this project, several observations were made of conditions which require remedial action, or that could provide additional energy savings, but were outside the scope of work for this study. These observations and recommended courses of action are:

- Cleaver-Brooks Boiler Feedwater Treatment: Chemical treatment for the skid-mounted fire-tube steam boiler installed in Building 117-2 is insufficient. Records

made available summarizing boiler feedwater treatment chemicals used indicate that the feedwater is not properly softened, nor is enough sulfite added to provide adequate oxygen removal (See Appendix E). Since there is essentially no condensate returned from the steam distribution system, the boiler system is a once-through system. Raw water has a hardness concentration of about 150 parts per million, a fairly high value. Scaling and corrosion on the water side of the boiler may soon cause the boiler to experience operating problems. It is recommended that a proper course of boiler feedwater treatment be instituted in coordination with the manufacturer's representative of the boiler. Additionally, the boiler water side should be inspected as soon as feasible to determine the magnitude of the existing scaling and corrosion problems and any immediate remedial actions that may be needed.

- Electric Domestic Hot Water Heating: Water heaters serving the wet chemistry laboratory and locker rooms (with showers) in the Services and Support Building 117-1 are electric powered. Water heating can be performed much more cost effectively using either steam heat exchangers or fired heaters. A propane fired hot water boiler is installed to provide heating service to this building whenever the steam plant in Building 117-2 is shut down. This boiler might be converted for domestic hot water heating. A separate double-walled heat exchanger could be installed to heat domestic hot water to utilize hot ethylene-glycol presently serving the space heating system.

- Outside Air Inlet for Building 117-1: The outside air inlet to the Services and Support Building air handling system is covered by plywood. No ventilation air is reaching occupants of the building except that which infiltrates through propped-open exterior doors. The plywood barrier should be removed and the air handling system zone dampers rebalanced manually until the recommended DDC control retrofit project (see Appendix D) is implemented.

F:\PROJ\1640316\WORD\ARMY_IND.SRV
941209

Table 4-1. Simulated Baseline Energy Use for Evaluations of Energy Conservation Opportunities

Building Number	Description	Building SF	Fuel Oil HVAC kkBTU/Yr	Fuel Oil Process kkBTU/Yr	Fuel Oil Total kkBTU/Yr	Electric Power Consumption HVAC kWH/Yr	Lighting kWH/Yr	DHW kWH/Yr	Process kWH/Yr	Total kWH/Year
117-1	Service & Support	9,181	905	-	905	154,738	79,148	137,397	0	371,283
117-2	Power Plant (partial)	13,500	negligible	-	0	negligible	20,713	0	184,756	205,470
117-3	Decontamination of Small Items	13,957	1,060	-	1,060	156,938	166,104	6,881	0	329,923
117-4	Bulk Explosives Disposal	8,733	4,487	-	4,487	105,126	92,968	4,306	0	202,399
117-5	Refining Building	6,439	764	3,862	4,626	151,843	118,729	3,175	0	273,746
117-6	Steamout Building	11,780	7,105	7,066	14,171	252,746	107,035	5,808	1,352,872	1,718,461
117-7	Water Treatment	3,320	included with 117-6 estimates				45,279	0	0	45,279
117-8	Mechanical Removal	8,134	610	-	610	91,988	79,281	4,010	0	175,280
117-10&11	Preparation & Accumulator	11,447	1,294	-	1,294	140,555	190,209	5,644	0	336,408
117-15	Flashing Chamber	7,385	0	-	0	negligible	15,974	0	0	15,974
Totals		69,671	16,223	10,928	24,764	1,053,934	915,441	167,220	1,537,629	3,674,223
Adjusted Fuel oil usage after removing steam leakage			13,836							

This simulated baseline energy consumption summary does not include minor amounts of propane used at building 117-1, nor does it include all process uses of No. 2 Fuel Oil other than that used to generate high pressure steam at building 117-2. The simulated baseline is developed to provide a realistic "future" baseline under which energy conservation opportunities are evaluated. Use of actual energy consumption records for the few years in which they are available would skew the results of evaluations unfairly since the Western Area Demilitarization Facility has not been operating at full capacity.

F:\PROJ\1640316\ENGR\TAB4-123.XLS Baseline Table 4-1

Table 4-2. Summary of Analysis Results for Recommended Energy Conservation Opportunities

Description of Energy Conservation Opportunity	Energy Savings: Electric kWH/Yr	Demand kW	Fuel Oil Million BTU/Yr	Energy $/Year	Energy LCC$	O & M Savings: Savings $/Year	Savings LCC$	Total Savings: Annual $/Year	Life Cycle LCC$	Retrofit Invest-ment $	Economic Analysis: SIR	Payback Years
Central Steam Plant and Distribution System Energy Conservation Opportunities (Refer to Appendix E)												
Replace Building Condensate Return Systems	0	0.0	1,100	$6,743	$95,957	$0	$0	$6,743	$95,957	$64,200	1.49	9.52
Reduce Steam Pressure, Install New Deaerator, and Repair Steam Leaks	0	0.0	21,218	$130,030	$1,850,332	($2,714)	($32,402)	$115,725	$1,687,577	$202,624	8.33	1.75
Install Oxygen Trim Combustion Controls & Flue Economizer	(8,009)	(0.91)	1,435	$8,348	$119,770	($2,501)	($29,856)	$5,847	$89,914	$60,280	1.49	10.31
Subtotal: Central Steam Plant Energy Conservation Opportunities	**(8,009)**	**(0.91)**	**23,753**	**$145,121**	**$2,066,059**	**($5,214)**	**($62,258)**	**$128,315**	**$1,873,447**	**$327,104**	**5.73**	**2.55**
Building Envelope, HVAC System Control and Heat Recovery Energy Conservation Opportunities (Refer to Appendix D)												
Bldgs 117-1,3,4,5,6,8,10&11 HVAC System: Install DDC Controls Retrofits	96,962	60.8	4,779	$39,743	$371,451	$42,079	$358,934	$138,429	$1,296,453	$739,286	1.75	5.34
Bldgs 117-5 & 117-6: Install Air Curtains on Roll-Up Doors	(27,798)	(4.95)	1,218	$5,744	$112,676	($42)	($619)	$5,702	$112,057	$37,777	2.97	6.62
Bldg 117-5 & 117-6: Install Exhaust Air Heat Recovery Run-Around Loop	3,763	(0.28)	3,997	$24,631	$456,924	($2,032)	($30,234)	$22,599	$426,690	$113,461	3.76	5.02
Subtotal: Building HVAC System and Heat Recovery ECOs	**72,927**	**55.6**	**9,994**	**$70,118**	**$941,051**	**$40,006**	**$328,081**	**$166,730**	**$1,835,200**	**$890,524**	**2.06**	**5.34**
Process Equipment Insulation Energy Conservation Opportunities (Refer to Appendix F)												
Repair Building 117-5 & 6 Melt Kettle and Separation Tank Insulation	0	0.00	713	$4,368	$62,164	$0	$0	$3,665	$53,687	$5,907	9.09	1.61
Central Air Compressor System Energy Conservation Opportunities (Refer to Appendix I)												
Replace Existing with SSR 2-Stage Rotary Screw; Use Existing Air Dryers	293,959	59.93	0	$18,987	$286,329	($2,234)	($33,240)	$19,577	$309,560	$166,795	1.86	8.52
High Pressure Water Pump, Steamout Building Annex 117-6A Energy Conservation Opportunities (Refer to Appendix J)												
Install Variable Speed Drive Retrofits on High Pressure Water Pumps	612,442	0.00	0	$26,796	$404,089	$0	$0	$26,796	$404,089	$168,767	2.39	6.30

F:\PROJ\1640316\ENGR\TAB4-123.XLS ECO Sum Table 4-2

Table 4-2. Summary of Analysis Results for Recommended Energy Conservation Opportunities

Description of Energy Conservation Opportunity	Energy Savings Electric kWH/Yr	Demand kW	Fuel Oil Million BTU/Yr	Energy $/Year	Energy LCC$	O & M Savings $/Year	O & M Savings LCC$	Total Savings Annual $/Year	Total Savings Life Cycle LCC$	Retrofit Investment $	Economic Analysis SIR	Payback Years
Lighting Fixture and Lighting Control Energy Conservation Opportunities (Refer to Appendix H)												
Lighting Fixture Delamping Retrofits												
LD-1: 2-Lamp F40T12 to 1-Lamp F32T8 with Electronic Ballast	879	0.22	0	$61	$732	$7	$82	$68	$815	$302	2.69	4.46
LD-2: 4-Lamp F40T12 to 2-Lamp F32T8 with Electronic Ballast	22,109	6.33	0	$1,614	$19,400	$196	$2,344	$1,810	$21,745	$5,268	4.13	2.91
Lighting Fixture Retrofits												
LF-1: Retrofit LED Lamp Kit in Existing Exit Lights	12,879	1.47	0	$714	$8,584	($57)	($676)	$658	$7,908	$6,037	1.31	9.18
LF4B: Delamp 4-Lamp F40T12s to 2xF32T8s, Reflector, Electronic Ballast	54,275	13.10	0	$3,713	$44,635	$371	$4,434	$4,085	$49,069	$9,925	4.94	2.43
LF-5: Replace 100W Lamp & Base with DTT-26W Compact Fluorescent	1,366	0.39	0	$100	$1,197	$63	$756	$163	$1,953	$309	6.33	1.90
LF-6: Replace 150W Lamp & Base with DTT-26W Compact Fluorescent	215	0.35	0	$45	$537	$8	$67	$50	$604	$154	3.91	3.07
LF-7: Retrofit Exterior 175W MV Fixture with 50W HPS Lamp & Ballasts	71,129	16.28	0	$4,776	$57,413	($261)	($3,116)	$4,515	$54,297	$24,991	2.17	5.53
LF-8: Retrofit Explosion Proof 400W MH with 250W HPS Lamps & Ballasts	38,818	7.68	0	$2,483	$29,850	$175	$2,084	$2,658	$31,934	$10,980	2.91	4.13
Subtotal, Recommended Lighting Energy Conservation Opportunities	**201,669**	**45.82**	**0**	**$13,507**	**$162,349**	**$501**	**$5,976**	**$14,007**	**$168,325**	**$57,967**	**2.90**	**4.14**
Total Recommended ECOs	**1,172,989**	**160**	**34,460**	**278,898**	**3,922,040**	**33,058**	**238,559**	**359,091**	**4,644,308**	**1,617,064**	**2.87**	**4.50**

Table 4-3. Summary of Analysis Results for Energy Conservation Opportunities Not Recommended

(Energy Conservation Opportunities with SIR's below 1.25)

Description of Energy Conservation Opportunity	Energy Savings: Electric kWH/Yr	Demand kW	Fuel Oil Million BTU/Yr	Energy $/Year	Energy LCC$	O & M Savings: Savings $/Year	Savings LCC$	Total Savings: Annual $/Year	Life Cycle LCC$	Retrofit Investment $	Economic Analysis: SIR	Payback Years
Process Heat Recovery and Insulation Energy Conservation Opportunities (Refer to Appendix F)												
Recover Heat from Rotary Furnace Flues for Building 117-3 Heating	(3,223)	0.00	747	$4,436	$82,870	($922)	($13,725)	$3,514	$69,145	$68,872	1.00	19.60
	Although this ECO shows an SIR of just over 1, the project is not recommended for implementation due to the marginal results.											
Recover Heat from Building 117-4 Incinerator Flues for Space Heating	This project is not evaluated because it is very similar to the process heat recovery project evaluated above. Better economics are not expected.											
Recover Heat from Building 117-15 Flashing Chamber Flue for Heating	This project cannot be installed without performing major process changes. Backpressure from a coil mounted in the flue would unbalance the process, possibly causing noncompliance with EPA pollutant discharge limits. (The units were recently tested for compliance; the system is sensative to changes in flue gas flow adjustments).											
Central Air Compressor System Energy Conservation Opportunities (Refer to Appendix I)												
Replace Air Compressors with Model LL5 Compressors & Desiccant Dryer	257,211	34.21	0	$14,751	$222,442	($3,156)	($46,968)	$16,371	$271,001	$235,684	1.15	14.40
Replace Air Compressors with Model LL5 Compressors; use existing Dryers	257,129	48.00	0	$16,156	$243,632	($3,217)	($47,869)	$15,763	$252,234	$240,202	1.05	15.24
Replace Existing with SSR 2-Stage Rotary Screw and Desiccant Air Dryer	265,330	41.67	0	$15,868	$239,297	($2,448)	($36,422)	$18,197	$298,403	$182,761	1.63	10.04
Building Envelope, HVAC System Control and Heat Recovery Energy Conservation Opportunities (Refer to Appendix D)												
Exhaust Heat Recovery - Single Story Industrial Bldg (117-3 as a Model)	(504)	(0.09)	124	$730	$13,670	($677)	($10,078)	$53	$3,593	$20,901	0.17	394.75
Wall Insulation - Single Story Indstrial Building (117-3 as a Model)	155,142	0.00	875	$528	$9,985	$0	$0	$528	$9,985	$25,081	0.40	2.33
Wall Insulation - Tower Type Indstrial Building (117-5 as a Model)	128,710	0.00	246	$3,605	$66,096	$0	$0	$3,605	$66,096	$67,749	0.98	18.79
High Pressure Water Pump, Steamout Building Annex 117-6A Energy Conservation Opportunities (Refer to Appendix J)												
Replace HP Pump Electric Motors with Internal Combustion Engines	1,352,872	433.61	(6,318)	$64,791	$841,919	($8,237)	($122,564)	$50,075	$622,947	$513,722	1.21	10.26

Table 4-3. Summary of Analysis Results for Energy Conservation Opportunities Not Recommended

(Energy Conservation Opportunities with SIR's below 1.25)

Description of Energy Conservation Opportunity	Energy Savings: Electric kWH/Yr	Demand kW	Fuel Oil Million BTU/Yr	Energy $/Year	Energy LCC$	O & M Savings: Savings $/Year	Savings LCC$	Total Savings: Annual $/Year	Life Cycle LCC$	Retrofit Invest-ment $	Economic Analysis: SIR	Payback Years
Lighting Fixture and Lighting Control Energy Conservation Opportunities (Refer to Appendix H)												
Lighting Fixture Retrofits												
LF-2: Retrofit Electronic Ballast & 1xF32T8 in 1-Lamp F40T12 Fixture	858	0.49	0	$88	$1,058	($1)	($13)	$87	$1,045	$1,791	0.58	20.60
LF-3A: Retrofit Electronic Ballast & 2xF32T8 in 2-Lamp F40T12 Fixtures	18,592	4.68	0	$1,291	$15,521	($32)	($388)	$1,259	$15,133	$15,144	1.00	12.03
LF-3B: Electronic Ballast & 2xF32T8 Lamps in Industrial 2-Lamp F40T12s	21,890	8.10	0	$1,786	$21,463	($29)	($346)	$1,757	$21,118	$24,973	0.85	14.22
LF-4A: Electronic Ballast & 4xF32T8 Lamps in Existing 4-Lamp F40T12s	24,448	5.90	0	$1,673	$20,106	($36)	($435)	$1,636	$19,671	$18,190	1.08	11.12
ECO LF-4 has two options; option LF-4B, with better economics, is recommended for implementation. See Table 4-1.												
Lighting Control Retrofits												
LC-1: Install Ceiling Mounted Passive Infrared (PIR) Motion Sensors	9,715	0.00	0	$425	$5,109	$0	$0	$425	$5,109	$9,566	0.53	22.51
LC-2: Install Ceiling Mounted Ultrasonic Motion Sensors	2,969	0.00	0	$130	$1,561	$0	$0	$130	$1,561	$6,776	0.23	52.16
LC-3: Replace Wall-Switches with Passive Infrared (PIR) Switches	4,888	0.00	0	$214	$2,571	$0	$0	$214	$2,571	$2,269	1.13	10.61

APPENDIX A

Scope of Work and Minutes of Project Meetings

SUPPLEMENTAL (DETAILED) SCOPE OF WORK

FOR AN

ENERGY SURVEY OF ARMY INDUSTRIAL FACILITIES

SUBJECT: Energy Engineering Analysis Program (EEAP), Western Area Demilitarization Facility (WADF), Hawthorne Army Ammunition Plant (HWAAP), Hawthorne, NV

CONTRACT NO. DACA05-92-C-0155

A-E ADDRESS: Keller and Gannon
1453 Mission Street
San Francisco, California 94142-2430

POINT OF CONTACT: Mr. Richard Lennig

PHONE NO: (415) 621-1199 FAX NO: (415) 684-3681

1. Project Data:

1.1 Installation and Location: Western Area Demilitarization Facility (WADF), Hawthorne Army Ammunition Plant (HWAAP), Hawthorne, Nevada

1.2 Study Title: EEAP, Energy Survey of Army Industrial Facilities

1.3 Project Number: 081

1.4 Authorization: CEMP-ET memorandum dated 9 Dec 93, subject: Energy Engineering Analysis Program (EEAP) - FY94.

1.5 References:

1.5.1 CESAM-EN-CM General Scope of Work (GSOW) for an Energy Survey of Army Industrial Facilities dated Oct 93.

1.5.2 Energy Engineering Analysis Program Study and Criteria Review for the Western Area Demilitarization Facility at Hawthorne Army Ammunition Plant, Hawthorne, Nevada, dated Dec 93.

2. Project Description/Services: Conduct an energy audit for facilities listed in Table 2-1 of ref 1.5.2. The energy audit shall be conducted in accordance with paragraph 3.3 of ref 1.5.2 and ref 1.5.1. Buildings 117-9, 117-12, 117-13, 117-14, and 117-15A listed in Table 2-1 are not part of this study and will not be audited. Work and services also include the following:

2.1 Establishment of baseline conditions for the buildings listed in Table 2-1 as specified in paragragh 3.4 of ref 1.5.2.

2.2 Energy Conservation Opportunity (ECO) Analysis: The specific

Energy Conservation Opportunities (ECO's) listed in Table 3-1 of ref 1.5.2 shall be evaluated in accordance with paragraph 3.5 of ref 1.5.2. The work and services also include tasks and requirements described and specified in paragraphs 3.3, 3.4, and 3.5 of ref 1.5.2.

This Supplemental Scope of Work (SSOW) along with reference 1.5.2 make up the detailed scope of work for this study and supplements the GSOW (ref 1.5.1) by identifying specific facilities, equipment, operations, systems, and ECO's to be included in this study. Should there be a conflict between the GSOW and the SSOW, the SSOW shall govern.

3. Submittals and Periods of Service: Submittals and periods of service shall be as specified below.

3.1 Interim Report: The interim report is due one hundred twenty (120) calendar days after receipt of the Notice to Proceed (NTP). The interim report shall conform with the requirements specified in the GSOW.

3.2 Final Report: The final report is due sixty (60) calendar days after the review conference for the intrim report. The final report shall conform with requirement specified in the GSOW.

3.3 A one day review conference will be held at the installation within ten days after the receipt of Government comments for the interim report. (Assume one A-E representative will attend review conference). The Sacramento District's technical manager will coordinate conference date and time.

4. Government Furnished Documents:

4.1 Government furnished documents are identified in paragraph 3.7 of ref 1.5.2.

4.2 Available as-built drawings and information (records, brochures, etc).

4.3 Available energy and/or operations studies.

4.4 The latest MCP Index.

5. Points of Contact: Points of contact during the study are as noted below:

5.1 Mr. Floyd Justus, SWCHW-DR, Hawthorne Amry Ammunition Plant (HWAAP), Hawthorne, NV, (702) 945-7340.

5.2 Mr. Tony Battaglia, CESAM-EN-CM, Mobile District, Mobile, AL, (205) 690-2618.

5.3 Mr. Nathaniel Hunter, CESPK-ED-M, Sacramento District, US Army Corps of Engineers, Sacramento, CA, (916) 557-7413.

6. Submittal Distribution: Report submittals and distribution shall be as specified below:

6.1 CDR, HQUSACE, ATTN: CEMP-ET (Mr. Dan Gentil), 20 Massachusetts Avenue, NW, Washington, DC, 20314-1000 - One (1) copy of Executive

Avenue, NW, Washington, DC, 20314-1000 - One (1) copy of Executive Summary at final submittal, only.

6.2 CDR, US Army Materiel Command, ATTN: AMCEN, 5001 Eisenhower Avenue, Alexandria, VA, 22333-6000, one copy.

6.3 CDR, USAMC (I&SA), ATTN: Industrial Operations Command (IOC) (Mr. Robert Burchett), Rock Island, IL, 61299-7190, one copy.

6.4 CDR, Hawthorne Army Ammunition Plant, ATTN: SWCHW-OR (Mr. Floyd Justus), Hawthorne, NV, 89415-5000, four (4) copies.

6.5 CDR, USAED, Mobile, ATTN: CESAM-EN-C (Mr. Tony Battaglia), P.O. Box 2288, Mobile, AL, 36628-0001, one copy.

6.6 CDR, USAED, South Pacific, ATTN: CESPD-ED-TE (Mr. Foo Eng), 630 Sansome Street, San Francisco, CA, 94111-2206, one copy.

6.7 CDR, USAED, Sacramento, ATTN: CESPK-ED-M (Mr. Nathaniel Hunter), 1325 J Street, Sacramento, CA, 95814-2922, five (5) copies.

7. A computer program will be used to analyze and model building HVAC system - see paragraph 3.4.3 of reference 1.5.2.

Note: A computer program titled "Life Cycle Costing in Design" (LCCID) is available from the BLAST Support Office in Urbana, Illinois for a nominal fee. This program can be used for performing the economic calculations for ECIP and non-ECIP ECOs. The BLAST Support Office can be contacted at 144 Mechanical Engineering Building, 1206 West Green Street, Urbana, IL, 61801. The telephone number is (217) 333-2977 or (800) UI-BLAST."

8. The A-E is cautioned to take no guidance from any source other than the Contracting Officer during the course of this work. The A-E shall immediately notify the Sacramento District Technical Manger of any such requests.

NATHANIEL HUNTER
Technical Manager

CF:
A-E, Keller and Gannon (Mr. Lennig)
HQ IOC, Rock Island, IL (Mr. Burchett)
HWAAP, SMCHW-OR (Mr. Floyd Justus)

cc: Mil Proj Br; A-E Nego/Spt Sec; Army/IS Sec (Hunter)(Orig)

CESAM-EN-CM October 1993

GENERAL SCOPE OF WORK

FOR AN

ENERGY SURVEY OF ARMY INDUSTRIAL FACILITIES

Performed as part of the

ENERGY ENGINEERING ANALYSIS PROGRAM (EEAP)

SCOPE OF WORK
FOR AN
ENERGY SURVEY OF ARMY INDUSTRIAL FACILITIES

TABLE OF CONTENTS

1. BRIEF DESCRIPTION OF WORK: The Architect-Engineer (AE) shall:

1.1 Perform a complete energy audit and analysis of the industrial facility.

1.2 Identify all Energy Conservation Opportunities (ECOs) including low cost/no cost ECOs and perform complete evaluations of each.

1.3 Prepare programming and implementation documentation for all justifiable energy conservation opportunities.

1.4 List and prioritize all recommended energy conservation opportunities.

1.5 Prepare a comprehensive report which will document the work accomplished, the results and the recommendations.

2. GENERAL

2.1 A coordinated energy study, including a detailed energy survey, shall be accomplished for the industrial facility. The study shall integrate the results of and any available data from prior or ongoing energy conservation studies, projects, designs, or plans. This Scope of Work is not intended to prescribe the methods in which the study is to be conducted or limit the AE in the exercise of his professional engineering expertise, good judgment or investigative ingenuity. However, the information and analyses outlined herein are considered to be minimum essentials for adequate performance of this study. The study shall include a comprehensive energy report documenting study methods and results.

2.2 All ECOs recommended shall comply with all current criteria (e.g., environmental, safety) for the industrial facility. These criteria may have changed since the facility was constructed. Replacement of people with automation systems may allow reductions in outside air quantities, ventilation rates, and similar items resulting in significant energy savings. Stated requirements for special environments (temperature/humidity control) for industrial equipment and processes shall be researched as needed by the AE to verify (a) the requirement and (b) the degree of control essential for the industrial mission.

2.3 All recommended ECOs, including maintenance, operational and low cost/no cost opportunities as well as Energy Conservation Investment Program (ECIP) and Energy Conservation and Management Program (ECAM) projects shall be ranked in order of highest to lowest Savings to Investment Ratio (SIR).

2.4 Other studies performed under the Energy Engineering Analysis Program (EEAP) have been accomplished for the installation. Applicable portions of the studies if any, shall be updated as needed and incorporated into the report. The report shall list the recommended ECOs from the previous studies that pertain or should pertain to industrial facilities processes. This list shall summarize the ECOs (cost, short description, and anticipated energy savings) and identify the fiscal year for which the project was or is programmed. Any industrial-facility-related ECO identified in the previous studies but not recommended shall be reevaluated under this contract. Any industrial-facility-related ECO recommended from the previous studies but not implemented nor programmed for implementation shall be updated in accordance with the latest ECIP criteria.

2.5 The terms "industrial", "production", and "process" are used interchangeably in this Scope of Work and should be interpreted broadly to include research, test and development, end item maintenance and repair, supply and distribution, as well as the typical "production centers" in Army industrial facilities. The term "facility" means one or more buildings or enclosures together with the equipment installed therein. It implies an integrated production system which requires a coordinated approach to achieve the best overall results.

2.6 The "Energy Conservation Investment Program (ECIP) Guidance," described in letter from CEHSC-FU-M, dated 4 November 1992, establishes criteria for ECIP/ECAM Projects and shall be used for performing the economic analyses of all ECOs and projects. Construction cost escalation for DD Form 1391 submission shall be calculated using the guidelines contained in AR 415-17 and the latest Tri-Service MCP index. The Tri-Service MCP Index, when updated, is contained in the latest applicable edition of the Engineer Improvement Recommendation System (EIRS) bulletin.

2.7 Energy conservation opportunities determined to be technically and economically feasible shall be developed into projects acceptable to installation personnel. This may involve combining similar ECOs into larger packages which will qualify for ECIP/ECAM or MCA funding, and determining, in coordination with installation personnel, the appropriate packaging and implementation approach for all feasible ECOs.

2.8 Projects which qualify for ECIP/ECAM funding shall be identified, separately listed, and prioritized by Savings to Investment Ratio.

2.9 All energy conservation opportunities shall be listed and prioritized by SIR.

3. PROJECT MANAGEMENT

3.1 Project Managers. The AE shall designate a project manager to serve as a point of contact and liaison for work required under this contract. Upon award of this contract, the individual shall be immediately designated in writing. The AE's designated project manager shall be approved by the Contracting Officer prior to commencement of work. This designated individual shall be responsible for coordination of work required under this contract. The Contracting Officer will designate a project manager to serve as the Government's point of contact and liaison for all work required under this contract. This individual will be the Government's representative.

3.2 Installation Assistance. The Commanding Officer or contractor operator at each installation will designate an individual who will serve as the point of contact for obtaining information and assisting in establishing contacts with the proper individuals and organizations as necessary to accomplish the work required under this contract.

3.3 Public Disclosures. The AE shall make no public announcements or disclosures relative to information contained or developed in this contract, except as authorized by the Contracting Officer.

3.4 Meetings. Meetings will be scheduled whenever requested by the AE or the Contracting Officer for the resolution of questions or problems encountered in the performance of the work. The AE and/or the designated representative(s) shall be required to attend and participate in all meetings pertinent to the work required under this contract as directed by the Contracting Officer. These meetings, if necessary, are in addition to the presentation and review conferences.

3.5 Site Visits, Inspections, and Investigations. The AE shall visit and inspect/investigate the site of the project as necessary and required during the preparation and accomplishment of the work.

3.6 Records

3.6.1 The AE shall provide a record of all significant conferences, meetings, discussions, verbal directions, telephone conversations, etc., with Government representative(s) relative to this contract in which the AE and/or designated representative(s) thereof participated. These records shall be dated and shall identify the contract number, and modification number if applicable, participating personnel, subject discussed and conclusions reached. The AE shall forward to the Contracting Officer within ten calendar days, a reproducible copy of the records.

3.6.2 The AE shall provide a record of requests for and/or receipt of Government-furnished material, data, documents, information, etc., which if not furnished in a timely manner, would significantly impair the normal progression of the work under this contract. The records shall be dated and shall identify the contract number and modification number, if applicable. The AE shall forward to the Contracting Officer within ten calendar days, a reproducible copy of the record of request or receipt of material.

3.7 Interviews. The AE and the Government's representative shall conduct entry and exit interviews with the Facilities or Plant Engineer and other interested managers before starting work at the installation and after completion of the field work. The Government's representative shall schedule the interviews at least one week in advance.

3.7.1 Entry. The entry interview shall describe the intended procedures for the survey and shall be conducted prior to commencing work at the facility. As a minimum, the interview shall cover the following points:

a. Schedules.

b. Names of energy analysts who will be conducting the site survey.

c. Proposed working hours.

d. Support requirements from the Facilities or Plant Engineer.

e. Limitations imposed by plant operations.

f. Plant security and safety procedures.

3.7.2 Exit. The exit interview shall include a thorough briefing describing the work accomplished, problems encountered, probable areas of energy conservation, and any follow-on efforts which may be required.

4. SERVICES AND MATERIALS. All services, materials (except those specifically enumerated to be furnished by the Government), labor, superintendence and travel necessary to perform the work and render the data required under this contract are included in the lump sum price of the contract.

5. PROJECT DOCUMENTATION. All energy conservation opportunities which the AE has considered shall be included in one of the following categories and presented in the report as such:

5.1 ECIP/ECAM Projects. To qualify as an ECIP/ECAM project, an ECO, or several ECOs which have been combined, must have a construction cost estimate greater than $300,000, a Savings to Investment Ratio greater than one, and a simple payback period of less than ten years. For ECAM projects, the $300,000 limitation may not apply. The AE shall check with the installation for guidance. The overall project, and each discrete part of the project, shall have a SIR greater than one. For all projects meeting the above criteria, complete programming documentation will be required. Programming documentation shall consist of a DD Form 1391, life cycle cost analysis summary sheet(s) (with necessary backup data to verify the numbers presented), and a project development brochure (PDB). These forms shall be separate from the report. They shall be bound similarly to the final report in a manner which will facilitate repeated disassembly and reassembly. A life cycle cost analysis summary sheet shall be developed for each ECO and for the overall project when more than one ECO is combined. For projects and ECOs updated or developed from the previous studies, the backup data shall consist of copies of the original calculations and analysis, with new pages updating and revising the original calculations and analysis. In addition, the backup data shall include as much of the following as is available: the increment of work under which the project or ECO was developed in the previous study, title(s) of the project(s), the energy to cost (E/C) ratio, the benefit to cost (B/C) ratio, the current working estimate (CWE), and the payback period. This information shall be included as part of the backup data. The purpose of this information is to provide a means to prevent duplication of projects in any future reports. For projects or ECOs the installation wants submitted as ECIP/ECAM projects, complete programming documentation shall be prepared.

5.1.1 Military Construction Project Data (DD Form 1391). These documents shall be prepared in accordance with AR 415-15 and the supplemental requirements in Annex B. A complete DD Form 1391 shall be prepared for each project. The form shall include a statement that the project results from an EEAP study. Documents shall be complete as required for submission to higher DA headquarters. These programming documents will require review and signatures by the proper installation officials. All documents shall be complete except for the required signatures.

5.1.2 Project Development Brochures (PDBs). Preparation of PDBs requires the AE to delineate the functional requirements of the project as related to the specific site. The AE shall prepare PDBs in accordance with AR 415-20 and TM 5-800-3. Most projects will not require all the forms and checklists included in the Technical Manual (TM). Only that information needed for the project shall be included. The PDB-I format described in the TM shall be used for whatever information is needed.

5.2 Non-ECIP Projects. Projects which do not meet ECIP criteria with regard to cost estimate or payback period, but which have an SIR greater than one shall be documented. Projects or ECOs in this category shall be provided with the following documentation: the life cycle cost analysis (LCCA) summary sheet completely filled out, a description of the work to be accomplished, backup data for the LCCA, ie, energy savings calculations and cost estimate(s), and the simple payback period. The energy savings for projects consisting of multiple ECOs must take into account the synergistic effects of the individual ECOs. In addition these projects shall have the necessary documentation prepared, as required by the Government's representative, for one of the following categories:

a. Quick Return on Investment Program (QRIP). This program is for projects which have a total cost greater than $3,000 but less than $100,000 and a simple payback period of two years or less.

b. Productivity Enhancing Capital Investment Program (PECIP). This program is for projects which have a total cost of greater than $3,000 but lees than $100,000 and a simple payback period of four years or less.

c. OSD Productivity Investment Funding (OSD PIF). This program is for projects which have a total cost of more than $100,000 and a simple payback period of four years or less.

The above programs and the required documentation forms are all described in detail in AR 5-4, Change No. 1.

d. Regular Military Construction Army (MCA) Program. This program is for projects which have a total cost greater than $300,000 and a simple payback period of ten to twenty-five years. Documentation shall consist of DD Form 1391 and a Project Development Brochure.

e. Low Cost/No Cost Projects. These are projects which the Facilities or Plant Engineer can perform using his resources. Documentation shall be as required by the Facilities or Plant Engineer.

5.3 Nonfeasible ECOs. All ECOs which the AE has considered but which are not feasible, shall be documented in the report with reasons and justifications showing why they were rejected.

6. DETAILED SCOPE OF WORK. The general Scope of Work is intended to apply to contract efforts for all Army installations included under this contract except as modified by the detailed Scope of Work for each individual installation. The detailed Scope of Work is contained in Annex B.

7. WORK TO BE ACCOMPLISHED

7.1 Audit. The audit consists of gathering data and inspecting industrial facilities in the field, including those which are government-owned, contractor operated (GOCO). These activities shall be closely coordinated with the contractor operator at GOCOs, facilities or plant engineer representatives, production engineers, the installation commander or his representative, and the Government's representative. The AE shall become thoroughly familiar with the facility and its industrial mission and undertake all necessary field trips to obtain required data. The AE shall consolidate or summarize the survey data to make it concise, and shall submit the summarized data as part of the report. Data sources shall be identified and assumptions clearly stated and justified. All test and/or measurement equipment shall be properly calibrated prior to its use.

7.1.1 Boiler plants, chilled water plants, incinerators, and similar facilities listed in Annex B that are associated with the industrial facility shall be included in the study. The intent is to determine the condition and efficiencies of existing equipment, operational procedures, adequacy of plant capacity, and heat recovery possibilities in addition to the general items listed.

7.1.2 During the audit process promising applications of renewable energy for industrial processes shall be identified. Large amounts of steam and hot water are used in industrial facilities dictating active consideration and analysis of potential renewable applications.

7.1.3 The audit shall be conducted with the view that the term "industrial facility" means an integrated production infrastructure including the building envelope, industrial equipment, process standards, materials, utilities and other components of the industrial operation which have an energy value. Envelope energy and process energy are interrelated. Inputs and outputs, particularly of thermal energy, should be balanced in order to optimize overall energy efficiency of industrial facilities. ECOs should therefore reflect the "systems" approach for a totally integrated facility, and assure that any energy tradeoffs between buildings and processes are analyzed.

7.1.4 Data collected during the audit shall, as a minimum, include:

7.1.4.1 Building data.

a. Building number, building age, number of floors, and gross square feet.

b. Floor area, HVAC zones, non-air-conditioned spaces, and usage of space ("industrial" or "other").

c. Glass areas, including type of glazing.

d. Wall and roof surface areas and condition, type of construction, and "U" factors.

e. Drawings, equipment schedules, shop layouts, utilities distribution diagrams, etc.

f. Nameplate data of energy-related building equipment.

g. Any major expansions, alterations, or modernization projects.

7.1.4.2 Weather information.

7.1.4.3 Operating methods.

a. Facilities operating hours (peacetime).

b. Personnel strength (direct labor).

c. Equipment operating and maintenance schedules for building systems and process systems.

d. Control set points, chilled water temperatures, and freeze protection temperatures.

e. Rooms, areas, or zones with special or critical requirements.

7.1.4.4 Past performance records.

a. Energy peak demands.

b. Latest annual energy consumption (Gross BTU/yr, BTU/SF/yr, BTU/end product/yr) for total installation and facility(ies) being studied.

c. Utility rate schedules.

d. Energy conservation projects (ECIP/ECAM/other) in facilities being studied.

7.1.4.5 Energy sources.

7.1.4.6 Production data.

a. Production areas by utilization (e.g., fabrication, finishing, assembly, test, storage, etc.).

b. Production equipment schedules, age, utilization, and energy requirements.

c. Production equipment replacement or modernization plans.

d. Process flow layouts.

e. Production rates/quantities.

f. Material handling systems.

g. Expected changes (equipment, process, facilities, workload, etc.).

7.2 Analysis. The energy analysis is a comprehensive study of the industrial facilities energy usage. It includes a detailed investigation of the operation, environment and equipment. Computer modeling shall be used to incorporate field survey data, weather data, production data, occupancy schedules, building construction data, energy distribution systems and equipment data into a model of the total facility. The computer program shall, for varying production rates (peacetime levels and full mobilization), develop load profiles, calculate energy savings, and evaluate the energy requirements of the industrial facility. The computer results should be verified by comparing them to any available past utility bills or records. Modeling will be done using a professionally recognized and proven computer program or programs that integrate architectural features with air-conditioning, heating, lighting and other energy-producing or consuming systems. These programs will be capable of simulating the features, systems, and thermal loads of the building under study. The program will use established weather data files and may perform calculations on a true hour-by-hour basis or may condense the weather files and the number of calculations into several "typical" days per month. The Detailed Scope of Work, Annex B, will list programs that are acceptable to the Contracting Officer. If the AE desires to use a different program, it must be submitted for approval with a sample run, an explanation of all input and output data, and a summary of program methodology and energy evaluation capabilities.

7.2.1 The energy analysis shall provide the following types of information:

a. A baseline of energy usage of the existing facility (at current production capacity prior to implementing ECOs generated by this study).

b. Comparison of equipment capacities with current workloads.

c. Energy usage by systems (lighting, heating, cooling, process, etc.).

d. Basis for evaluating ECOs.

e. A baseline of energy usage of the facility after incorporation of all recommended ECOs (assuming no change in production level).

7.2.2 The AE shall develop graphic presentations, i.e. graphs and charts which depict a complete energy consumption picture for the industrial facility both presently and after implementation of energy conservation opportunities and include these in the report.

7.2.3 The AE shall develop a listing of each shop, zone, or area of the facility as appropriate. The list shall include the air handling system temperature and humidity setpoints, lighting levels, number and types of light fixtures, differential pressure readings and similar data required for the analysis. The valid criteria requirements for supply, return and exhaust air quantities, temperature and humidity setpoints, lighting levels, etc., shall also be shown. The listing shall be in sufficient detail so that areas with potential energy savings can be identified. The AE shall be familiar with the latest Army environmental and safety criteria and shall evaluate installed systems for possible energy saving revisions which may be permitted by current criteria.

7.2.4 If data is available, the AE shall develop an historical load profile by year for the past three fiscal years for each energy source utilized.

7.3 Identify ECOs. All methods of energy conservation which are reasonable and practical shall be considered, including improvements of operational methods and procedures and maintenance practices as well as the physical facilities. A list of energy conservation opportunities is included as Annex A to this scope. This list is not intended to limit or guide the AE but only to assure that at least these opportunities are considered, discussed and documented in the report. Those items on the list which are not practical, have been previously accomplished, are inappropriate or can be eliminated from detailed analysis based on preliminary analysis shall be listed in the report along with the reason for elimination from further analysis. All potential ECOs which are not eliminated by preliminary considerations shall be thoroughly documented and evaluated as to technical and economic feasibility. The AE shall provide all data and calculations needed to support the recommended ECO. All assumptions shall be clearly stated. Calculations shall be prepared showing how all numbers in the ECO were figured. Calculations shall be an orderly step-by-step progression from the first assumption to the final number. Descriptions of the products, manufacturers catalog cuts, pertinent drawings, and sketches shall also be included. A life cycle cost analysis summary sheet shall be prepared for each ECO and included as part of the supporting data.

7.4 Energy Monitoring and Control Systems (EMCS)/Process Control System (PCS). DELETED

7.4.1 The AE shall determine the feasibility of an EMCS/PCS for the industrial facility. The intent of this study is to determine the basic conceptual architecture of the EMCS/PCS to the extent that primary economic calculations can be made to determine feasibility per ECIP criteria. The documentation shall be of sufficient accuracy to insure that future project design calcula-

tions that will be done after completion of this study will not deviate more than 20 percent from the results of this study.

7.4.2 The AE shall survey all buildings and perform feasibility evaluations in accordance with guidance in HNDSP-86-188-ED-ME. Any existing basewide EMCS project or any currently under design or study shall be considered and evaluated for integration. The AE shall consider connection of the industrial facility to this basewide system. The use of existing survey data is acceptable only if it is in sufficient detail and can be easily revalidated by building walk through inspections. The standard evaluation forms contained in HND-SP86-188-ED-ME shall be a part of the submittal. EMCS/PCS analyses and evaluations shall be developed using TM 5-815-2. EMCS costs shall be developed using Cost Estimating Guidelines: HNDSP-90-244-ED-ME. Energy savings calculations for EMCS/PCS shall be based whenever applicable on the results of the computer modeling discussed in par 7.2 above. Where the computer model is not applicable for a particular EMCS/PCS application, the standardized energy savings calculations pesented in Appendix C (CR82-030) of Naval Facilities Engineering Command document number UG-0010 may be used. An independent system for the industrial facility and some type of communication with the basewide system for monitoring and data gathering shall also be considered. EMCS/PCS evaluation shall consider but not be limited to the following features:

a. Start/Stop Programs DELETED

Scheduling
Duty cycling
Load shedding for electrical demand limiting
Lighting control
Start/Stop Optimization

b. Ventilation and Recirculation Programs

Dry bulb economizer
Outside air reduction
Industrial process economizer
Exhaust air reduction/optimization (based on production activity)

c. Temperature Reset Programs

Space temperature night setback
Process temperature night setback
Hot and cold deck
Reheat coil
Chilled water
Chiller selection
Boiler selection

d. Labor Savings/Monitoring (Example: Boiler plant monitoring or EMCS/PCS logging of points which at present are manually logged.)

e. Machine run time, production profiles and maintenance management

7.4.3 The AE's recommendations for an EMCS/PCS shall be in sufficient detail to define the system configuration, the approximate quantity and types of control instruments and sensors, and the data transmission system. The selection of points to be monitored and controlled shall be given priority based upon ECIP criteria. The control system functions, expected energy reduction, and monetary savings (including the manner in which these savings are to be achieved) shall be explained.

7.4.4 At those installations where certain buildings cannot be economically connected to an EMCS, alternate means of controls shall be evaluated. One method is single building EMCS and another is FM radio control.

7.4.5 The AE shall prepare and provide recommendations in narrative form. Input/output (I/O) summary tables shall be prepared and provided for each system selected in accordance with HNDSP-86-188-ED-ME. Cost estimates shall be prepared and provided in accordance with Cost Estimating Guidelines, HNDSP-90-244-ED-ME.

7.4.6 Inoperative controls shall be surveyed in accordance with TM 5-815-2. Cost estimates to repair and replace inoperative controls shall be as described in the Cost Estimating Guide.

7.4.7 Labor savings shall be included in the Life Cycle Cost Analysis.

7.5 Provide Programming or Implementation Documentation. During the Interim Review Conference, as outlined in paragraph 7.6.1, the AE will be advised of the Facilities or Plant engineers's preferred packaging of recommended ECOs into projects for implementation. These projects will be documented as outlined in paragraphs 5.1, 5.2, and 5.3. Programming documentation will be included in the Prefinal Submittal per par 7.6.2. Programming documents shall be separate from the narrative report, and they shall be bound similarly to the final report in a manner which will facilitate repeated disassembly and reassembly.

7.6 SUBMITTALS, PRESENTATIONS AND REVIEWS. The work accomplished shall be fully documented by a comprehensive report. The report shall have a table of contents and be indexed. Tabs and dividers shall clearly and distinctly divide sections, subsections, and appendices. All pages shall be numbered. The AE shall give a formal presentation of all but the final submittal to installation, command, and other Government personnel. The AE shall prepare slides or view graphs showing the results of the study to date for his presentation. During the presentation, the personnel in attendance shall be given ample opportunity to ask questions and discuss any changes deemed necessary to the study. A review conference will be conducted the same day, following the presentation. Each comment presented at the review conference will be discussed and resolved or action items assigned. The AE shall

provide the comments from all reviewers and written notification of the action taken on each comment to all reviewing agencies within three weeks after the review meeting. It is anticipated that each presentation and review conference will require approximately one working day. The presentation and review conferences will be at the installation on the date(s) agreeable to the industrial facilities personnel, the Facilities or Plant Engineer, the AE and the Government's representative. The Contracting Officer may require a resubmittal of any document(s), if such document(s) are not approved because they are determined by the Contracting Officer to be inadequate for the intended purpose.

7.6.1 Interim Submittal. An interim report shall be submitted for review after the field survey has been completed and an analysis has been performed on all of the ECOs. The report shall indicate the work which has been accomplished to date, illustrate the methods and justifications of the approaches taken and contain a plan of the work remaining to complete the study. Calculations showing energy and dollar savings and SIRs of all the ECOs shall be included. The simple payback period of all ECOs shall be calculated and shown in the report. The AE shall submit the Scope of Work and any modifications to the Scope of Work as an appendix to the report. A narrative summary describing the work and results to date shall be a part of this submittal. During the review period, the Covernment's representative shall coordinate with the industrial facilities personnel, and the Facilites or Plant Engineer to provide the AE with direction for packaging or combining ECOs for programming purposes and to indicate the fiscal year for which the programming or implementation documentation shall be prepared. A sample implementation document (DD Form 1391, sketches and manufacturers data, life cycle cost analysis summary sheet and supporting data) for one project shall be submitted with this submittal for review and approval. The survey forms completed during this audit shall be submitted with this report. The survey forms only may be submitted in final form with this submittal. They should be clearly marked at the time of submission that they are to be retained. They shall be bound in a standard three-ring binder which will allow repeated disassembly and reassembly of the material contained within.

7.6.2 ~~Prefinal~~ Final Submittal. The AE shall prepare and submit the prefinal report when all work under this contract is complete. The AE shall submit the Scope of Work for the installation studied and any modifications to the Scope of Work as an appendix to the submittal. The report shall contain a narrative summary of conclusions and recommendations, together with all raw and supporting data, methods used, and sources of information. The report shall integrate all aspects of the study. The report shall include an order of priority by SIR in which the recommended ECOs should be accomplished. The synergistic effects of all of the ECOs on one another shall have been determined and the results of the original calculations adjusted accordingly. Completed programming and implementation documents for all recommended projects shall be included. The programming and implementation documents shall be ready for review and signature by the installation com-

mander. The prefinal report, separately bound Executive Summary, and all appendices shall be bound in standard three-ring binders which will allow repeated disassembly and reassembly. The prefinal submittal shall be arranged to include (a) a separately bound Executive Summary to give a brief overview of what was accomplished and the results of this study using graphs, tables and charts as much as possible (See Annex C for minimum requirements), (b) the narrative report containing a copy of the Executive Summary at the beginning of the volume and describing in detail what was accomplished and the results of this study, (c) appendices to include the detailed calculations and all backup material and (d) the programming and implementation documentation. A list of all projects and ECOs developed during this study shall be included in the Executive Summary and shall include the following data from the life cycle cost analysis summary sheet: the cost (construction plus SIOH), the annual energy savings (type and amount), the annual dollar savings, the SIR, the simple payback period and the analysis date. For all programmed projects also include the year in which it is programmed and the programmed year cost.

7.6.3 Final Submittal. Any revisions or corrections resulting from comments made during the review of the prefinal report or during the presentation and review conference shall be incorporated into the final report. These revisions or corrections may be in the form of replacement pages, which may be inserted in the prefinal report, or complete new volumes. Pen and ink changes or errata sheets will not be acceptable. If replacement pages are to be issued, it shall be clearly stated with the prefinal submittal that the submitted documents will be changed only to comply with the comments made during the prefinal conference and that the volumes issued at the time of the prefinal submittal should be retained. Failure to do so will require resubmission of complete volumes. If new volumes are submitted, they shall be in standard three-ring binders and shall contain all the information presented in the prefinal report with any necessary changes made. Detailed instructions of what to do with the replacement pages should be securely attached to the replacement pages. DELETED

8. OPERATION AND MAINTENANCE INSTRUCTION. The AE shall prepare a one-day instructional course for the mechanical and electrical operation and maintenance personnel and affected production supervisors to explain possible energy saving potentials due to modified equipment and systems operation. The course will identify operational items noted during the audit, in both facilities and process areas, which will affect energy conservation, and will explain savings possible. This course will be held near the end of the study period at a time agreeable to the AE and the Government representative. This course is in addition to the formal review and presentations required. An outline of the topics that will be covered shall be submitted with the prefinal report. DELETED

ENERGY ENGINEERING ANALYSIS PROGRAM STUDY AND CRITERIA REVIEW

for the

WESTERN AREA DEMILITARIZATION FACILITY

at

HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

Prepared for

U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
SACRAMENTO, CALIFORNIA

Prepared by
KELLER & GANNON
Engineers • Architects
1453 Mission Street
Post Office Box 422430
San Francisco, CA 94142

DECEMBER 1993

Contract No. DACA05-92-C-0155

Table of Contents

1.0 INTRODUCTION

This Energy Engineering Analysis Program (EEAP) Study and Criteria Review for the Western Area Demilitarization Facility (WADF) at Hawthorne Army Ammunition Plant, Hawthorne, Nevada, was prepared for the U.S. Army Engineer District, Sacramento, under Contract No. DACA05-92-C-0155.

1.1 Objective

The primary objective of this task was to develop a facility specific scope of work for performing an EEAP study for WADF building support and industrial process systems. The effort included a site visit to visually inspect HVAC and process equipment, assemble facility and equipment data and collect historical energy consumption records.

1.2 Scope of Work

The scope of work for this EEAP study and criteria review was established by the U.S. Army Engineer District, Sacramento, in a document dated 26 August 1993. Authorization for this project was provided by AMSCM-EAF Memorandum dated 13 August 1993.

2.0 DESCRIPTION OF FACILITY

2.1 General

The function of the WADF at Hawthorne Army Ammunition Plant is to process Government-furnished munitions to reclaim explosive and scrap metal byproducts.

Of the fifteen individual facilities that comprise the WADF, only the Services and Support Building 117-1, the Boiler Building 117-2, and four of the industrial process facilities are currently in operation. Table 2-1 lists facilities, description. square footage, and current operational status.

2.2 Energy Sources

Electric power is provided to the Hawthorne Army Ammunition Plant by Sierra Pacific Power Company at 60kV. A 5000kVA, 60kV-12.5/7.2kV transformer is currently dedicated only to the WADF site. Electricity consumption metering is installed at the main WADF substation and at each of the nine distribution transformers listed in Table 2-2. Readings are taken weekly at the main WADF meter and weekly or less frequently, depending on operational status of the facilities served, at each of the distribution transformer sub-meters. Although all installed watthour meters contain maximum demand registers, WADF personnel do not record the kW demand reading and reset the register during their meter-reading rounds.

Low-sulfur No. 2 diesel fuel oil is supplied to the WADF and stored in three 33,000-gallon storage tanks.

Liquid propane gas is supplied to the Services and Support Building 117-1 to fire a small heating boiler.

Although the Boiler Building contains three 50,000 pounds per hour coal-fired steam boilers, these units are currently secured.

2.3 Historical Energy Consumption and Cost

Based on records maintained by HWAAP personnel, in FY 1993 the WADF consumed approximately 1,900,000 kWh of electricity and 302,500 gallons of No. 2 fuel oil, representing about 23 percent of overall HWAAP installation energy usage.

Current Sierra Pacific Power Company rates for electric power are $0.04484 per kWh consumption and $8.74 per kW demand. Average fuel oil costs were reported to be $0.75 per gallon during the summer and $.80 per gallon during the winter months.

Assuming that the demand factor for the WADF approximates that of the overall installation yields an estimated annual electric power cost for FY 1993 of $125,000. Using weighted average cost of fuel of $.78 per gallon yields an estimated fuel oil bill of $235,000 attributable to the WADF. Overall energy costs in FY 1993 for the WADF are, therefore, estimated to be $360,000.

2.4 Major Energy-Using Equipment

A description of major energy-consuming equipment at each WADF building is provided in Table 2-3.

TABLE 2-1
LIST OF FACILITIES

Building No.	Building Name	Building Area (SF)	Current Operating Status
117-1	Services and Support Building	9,600	operational
117-2	Boiler Building	13,500	operational
117-3	Decontamination and Small Items Building	21,650	operational
117-4	Bulk Explosives Disposal Building	9,085	non-operational
117-5	Refining Building	5,060	non-operational
117-6	Steamout Building and Addition	5,750 (N) 5,750 (S)	operational
117-7	Process Water Treatment Facility	3,320	operational
117-8	Mechanical Removal Building	8,250	non-operational
117-9	Large Cells Building	3,540	non-operational
117-10	Preparation Building	17,100	non-operational
117-11	Accumulator Building	2,470	non-operational
117-12	Off-Loading Dock	4,680	non-operational
117-13	Magazines Group A	1,875	non-operational
117-14	Magazines Group B	1,250	non-operational
117-15	Flashing Chamber	7,385	modified TVA-DF2
117-15A	Antechamber	N/A	decommissioned

TABLE 2-2
EXISTING TRANSFORMER DATA

Facilities Served	Rating kVA	Primary and Secondary Voltage	Type of Connection
all	5000	60kV - 12.5/7.2kV	Delta-wye
117-1	150	12.5kV - 277/480V	Delta-wye
117-2	1500	12.5kV - 277/480V	Delta-wye
117-3	500	12.5kV - 277/480V	Delta-wye
117-4	500	12.5kV - 277/480V	Delta-wye
117-5	300	12.5kV - 277/480V	Delta-wye
117-6 and 117-7	1000	12.5kV - 277/480V	Delta-wye
117-8 and 117-9	500	12.5kV - 277/480V	Delta-wye
117-10	750	12.5kV - 277/480V	Delta-wye
117-11	750	12.5kV - 277/480V	Delta-wye

TABLE 2-3
LIST OF MAJOR ENERGY-CONSUMING EQUIPMENT

Building	Item	Description
117-1	Boiler	2000 pounds-per-hour (pph) propane-fired boiler
117-2	Steam Boiler	17000 pph, 150 psig, Cleaver Brooks 100-400, No. 2 diesel fuel oil fired
117-2	Air Compressors	(3) 150 HP air compressors (Ingersoll-Rand)
117-3	Furnaces	(2) detonating item furnaces, (1) flashing furnace
117-4	Incinerators	(2) bulk-explosives incinerators
117-5	Autoclaves	(8) steam meltout autoclaves
117-6	High-Pressure Water Pumps	(5) 150 HP Butterworth pumps, 15,000 psig
117-7	Water Pumps	10 pumps totalling 175 HP

3. DETAILED SCOPE OF WORK

3.1 Project Data

3.1.1 Installation and Location: Western Area Demilitarization Facility (WADF) at Hawthorne Army Ammunition Plant (HWAAP), Nevada

3.1.2 Study Title: EEAP Industrial Facility Survey

3.1.3 Project Number: To be determined

3.1.4 Authorization: To be determined

3.2 Project Description/Services

3.2.1 The work and services for this project require a site-wide energy survey and evaluation of WADF buildings, processes, and energy distribution systems. Since process changes are difficult to implement due to the need for a unique procedure for each type of munitions processed, the study shall not include evaluation of industrial process changes. However, retrofits to reclaim heat generated by process equipment or to reduce demand loads of process equipment shall be evaluated.

The General Scope of Work (GSOW) describes and specifies the general requirements and procedures for conducting the study, documenting study findings, and preparation of the study reports.

3.2.2 This Detailed Scope of Work (DSOW) supplements the GSOW by identifying specific energy conservation opportunities (ECOs), facilities, systems and processes to be investigated in the study. Should there be a conflict between the GSOW and the DSOW, the DSOW shall govern.

3.3 Audit of Facilities

All facilities located at the WADF, both operational and nonoperational, shall be audited in accordance with the GSOW to the extent feasible. The combustion efficiency of all existing boiler installations, except the coal-fired units in Building 117-2 shall be determined by field testing.

3.4 Establishment of Baseline Conditions

3.4.1 Analyze available historical energy use records and establish baseline monthly average energy use for both electric power and No. 2 diesel fuel oil.

3.4.2 Determine the HVAC analysis design criteria for each building to include the following items:

a. Outdoor design conditions
b. Indoor design conditions
c. Requirements for 100 percent outside air
d. Recirculation airflow requirement
e. Pressurized or negative-pressure building
f. Filtration level required

3.4.3 Model the architectural features, HVAC systems, lighting, and industrial process energy-producing and consuming systems of all buildings using ~~the Trane Air Conditioning Economics (TRACE) 600~~ an approved computer program.

3.5 ECO Analysis

3.5.1 The A/E shall perform a complete life-cycle cost analysis for each ECO identified in Table 3-1. Each analysis shall consist of the following major tasks:

a. Completely describe the potential ECO, including sketches and catalog cuts.

b. Quantify annual energy savings (electricity kWh and gallons of fuel oil) and monthly kW demand savings, using the ~~TRACE 600~~ computer program where applicable.

c. Identify and quantify utility company rebates applicable to the project.

d. Develop a conceptual construction cost estimate to implement the ECO.

e. Summarize each analysis in the format of the ECIP Life-Cycle Cost Analysis (LCCA) Summary sheet, to include savings-to-investment ratio (SIR), simple payback period and internal rate-of-return (IRR).

3.5.2 Evaluation of energy monitoring and control systems/process control systems (EMCS/PCS) for the industrial facility, as described in the GSOW Paragraph 7.4, shall not be included in this study. Direct digital control (DDC) retrofits on a building-by-building basis shall be considered and evaluated.

3.6 Submittals and Periods of Service

3.6.1 Interim Report: The interim report shall be submitted one hundred twenty (120) calendar days after the receipt of the Notice To Proceed (NTP). The interim report contents and format and the interim report presentation shall conform with the requirements of the GSOW.

~~3.6.2 Pre-Final Report: The prefinal report shall be submitted seventy-five (75) calendar~~ days after the interim report presentation~~/review~~ conference. The prefinal submittal shall ~~conform with the requirements of the GSOW~~.

3.6.3 Final Report: The final report shall be submitted ~~thirty (30)~~ Sixty (60) calendar days after the prefinal review conference. The final report submittal shall conform with the requirements of the GSOW.

3.7 Government-Furnished Documents: The Government shall provide the following information to the A/E:

3.7.1 Building information schedule

3.7.2 Process equipment schedule

3.7.3 Utility procurement records

3.7.4 Equipment modernization/acquisition plan, if available

3.7.5 Equipment layout and utilization records

3.7.6 Latest copies of energy studies pertaining to the WADF

3.7.7 Energy Resources Management Plan, if available

3.7.8 Architectural, mechanical and electrical as-built construction drawings

3.7.9 Operation and Maintenance Manuals for the following process equipment:

a. Flashing furnace and item detonating furnaces
b. Bulk incineration system
c. Melt drain system
d. Hydraulic cleaning system
e. Process water treatment
f. Mechanical reduction systems
g. Gun ammunition breakdown system
h. Flashing chamber system

3.7.10 ETLS 1110-3-282, Energy Conservation and 1110-3-332, Economic Studies

3.7.11 Architectural and Engineering Instructions

3.7.12 Energy Conservation Investment Program (ECIP) Guidance, dated 4 Nov. 1992

3.7.13 TM 5-785, Engineering Weather Data; TM 5-800-2, General Criteria Preparation of Cost Estimates; TM 5-800-3, Project Development Brochure

3.7.14 AR 415-15, Military Construction Army (MCA) Program Development; AR 415-17, Cost Estimating for Military Programming; AR 415-20, Construction, Project Development and Design Approval; AR 415-28, Department of the Army Facility Classes and Construction Categories; AR 415-35, Construction, Minor Construction; AR 420-10, General Provisions, Organization, Functions, and Personnel; AR 11-27, Army Energy Program; and AR 5-4, Change No. 1, Department of the Army Productivity Improvement Program.

3.7.15 NCEL UG-0010, User Guide for Single Building Controllers

3.7.16 The latest applicable Engineer Improvement Recommendation System (EIRS) bulletin.

3.7.17 An example of a correctly completed programming document for an ECIP/ECAM project.

3.7.18 Production data.

TABLE 3-1
ENERGY CONSERVATION OPPORTUNITIES
WESTERN AREA DEMILITARIZATION FACILITY

ECO No.	Building	Item	Description
1	all	Lighting	Establish design criteria for each building; study existing lighting and potential fixture retrofits.
2	all	Steam Leaks	Investigate steam trap maintenance program and (especially) steam pits which contain seriously-leaking ball expansion joints. Reduce pressure to lowest practicable level required by process.
3	117-3	HVAC Systems	Replace (nonfunctional) pneumatic controls with DDC in three HVAC systems.
4	all	Hot Glycol Pump	Turn off hot-glycol recirculating pump when heating conditions permit.
5	all	Provide Strip Curtains	Provide strip curtains to prevent outdoor air from infiltrating buildings and adding heating or cooling load to system.
6	all	Insulation	Most buildings are non-insulated, poured-in-place concrete walls (12–24" thick) and concrete roofs (6–12" thick). Study adding 3½" thick insulation (R-11) to walls and 6" thick (R-19) roof insulation. This ECO may not be feasible, due to contamination in the buildings.
7	117-3 and others	Steam Pressure	Reduce steam pressure to lowest practicable level at all steam usage points
8	117-2	Compressed Air System	Reduce compressed air pressure to lowest practicable level at all usage points. Study increased storage capacity to reduce compressor run-times.
9	117-3	Heat Recovery	Recover heat via coil run-around loop on 100% outdoor air systems.
10	117-4	Waste Heat Boiler	Evaluate waste heat boiler to displace steam heating of hot glycol to building heating systems. Coordinate with RCRA Part B permitting.
11	117-5	Steam Autoclaves	Investigate better insulation on process lines, need for steam heating on process lines when system is not operating, etc.
12	117-6	(5) 150 HPS High-Pressure Water Pumps	Study DDC retrofit to "unload" motors during part-load conditions. Study substitution of No. 2 diesel-oil engine-generator set for 150 HP motors. Study "bypass" operation which causes overheating of recirculating water which causes pump cavitation.
13	117-7 (typical all mech. rooms)	Glycol-Water Pumps	Deactivate glycol-water pump when not needed.

ECO No.	Building	Item	Description
14	all (typical all mech. rooms)	HVAC Systems	Study heat recovery, DDC retrofit, and temperature controls.
15	117-55 117-6 North 117-6 South	Coil Run-Around	Recover exhaust air heat to preheat incoming air to building.
16	117-2	Steam Boiler	For Cleaver Brooks, 17,000 lb/hr, DF-2 fired boiler, study O_2 trim, waste-heat economizer, and tuneup for optimal efficiency.
17	117-15	Flashing Chamber	Evaluate waste-heat boiler to displace steam heating via heat recovery from 1500°F to 2000°F after-burner. Coordinate with TVA.

KELLER & GANNON
Engineers & Architects
Quality Services Since 1941

23 February 1995

MINUTES OF MEETING

AT: Directorate of Engineering & Housing, Hawthorne Army Ammunition Plant, Hawthorne, Nevada

ON: 22 February 1995, 0900

SUBJECT: Contract No. DACA05-92-C-0155
EEAP, Energy Survey of Western Area Demilitarization Facility
Hawthorne Army Ammunition Plant, Nevada

ATTACHMENTS:
(1) FAX of 16 February 1995 to Mr. Alex Azares, CESPK-ED-M (Army/ISS): Keller & Gannon Responses to Review Comments.
(2) Interim Submittal Review Comments from Mobile District, Corps of Engineers, Received by K&G on 6 February 1995.
(3) Interim Submittal Review Comments from the Sacramento District, Corps of Engineers and K&G Responses on the ARMS system dated 20 February 1995.

THOSE PRESENT:

Name	Affiliation	Telephone No.
Alex Azares	CESPK-ED-M (Army/ISS)	916-557-5126
Stephen Jones	Corps of Engineers, Sacramento Distr.	916-557-7216
		916-557-7850 FAX
James Purrell	ACO, Engineering	702-945-7590
		702-945-7968 FAX
Floyd Justus	ACO, Engineering	702-945-7340
Louis Dellamonica	ACO, Engineering	702-945-7354
David Waldron	DZB Engineering	702-945-7536
Richard C. Lennig	Keller & Gannon	415-621-1199
Blair I. Horst	Keller & Gannon	415-621-1199

1. The purpose of the meeting was to present findings of the subject study and to discuss and resolve review comments on the Interim Submittal.

1453 Mission Street, San Francisco, California 94103
Phone: (415) 621-1199 FAX: (415) 864-3681
Mail: P.O. Box 422430, San Francisco, CA 94142-2430

2. Findings of the subject Energy Study were presented to the assembled by Mssrs. Lennig and Horst.

3. Mr. Dave Waldron has recently assumed the responsibilities of Energy Coordinator for DZB. Mr. Horst offered to provide telephone numbers of Mssrs. Jack Nixon of the Yuma Proving Ground and William Stein of Fort Huachuca, energy coordinators for their receptive sites who may be able to provide guidance, as needed.

4. Interim submittal review comments and Keller & Gannon (K&G) responses were discussed. (Refer to Attachments 1 through 3). All K&G responses were accepted with the following clarification:

   Provide a summary of discussions with Mobile and Savannah District Corps of Engineer Centers of Technical Expertise regarding the acceptability of DDC controls retrofits with O&M type funding (FEMP) where they are not allowed with MCA (ECIP) funding.

5. Comments from Hawthorne Army Ammunition Plant were provided verbally by Mr. Louis Dellamonica. Comments and approved actions to be taken by K&G are as follows:

   a. Page 3-2, Section 3.3.5: There are four steamout autoclaves, not two.
      Response: Wording will be corrected.

   b. Page 3-2, Section 3.3.6: Change sentence "... to the washout steamout tables in Building 117-6." to read: "..to Building 117-6 South Tower."
      Response: Wording will be corrected.

   c. Page 3-3, Section 3.3.7, last sentence: Change the word "pumped" to "drained".
      Response: The word will be changed.

   d. Page 3-8, Figure 3-5; Page 4-9, Paragraph 4.5.6, etc.: Change the description "Reciprocating Air Compressor" to "Screw Air Compressor".
      Response: Wording will be corrected wherever used in the submittal to describe the existing air compressors.

   e. Page 4-6, Section 4.5.4: Modify descriptions of furnaces in Building 117-3.
      Response: Descriptions will be modified.

f. Page 4-9, Section 4.5.6, second paragraph: Delete the sentence: "System iterconnections should be removed".
Response: The sentence will be removed.

g. Page 4-10, Section 4.5.7, second paragraph: Change sentence from "... whenever the shakeout tables in Building 117-6 ..." to "... whenever the hydraulic cleaning equipment in the South Tower is operated in Building 117-6 ...".
Response: The sentence will be so modified.

h. Appendix E, Page E-1, first paragraph: Modify the historical description of the coal fired boilers to state that they were the smallest capacity dual fueled boilers available accepting both coal and fuel oil. The turn-down for these boilers is very poor, thus the smaller Cleaver Brooks fuel oil fired boiler was installed to improve efficiency.
Response: The description will be clarified.

i. Appendix E, Page E-1: The North Tower of Building 117-6 has a hot water heater served by line pressure steam (not at reduced pressure as are all other HVAC and process steam uses at WADF). Assure that this hot water heater is modified to accept lower pressure steam for the recommended Energy Conservation Opportunity (ECO) of lowering the distribution steam pressure.
Response: The 10% contingency in the cost estimate includes costs for such minor modifications and should be addressed during detailed design. (Mr. Dellamonica accepted this response and did not request that the text or calculations be modified.)

j. Appendix F, Page F-1, Paragraph "Heat Recovery from Processing in Building 117-3": Change sentence from "... materials, quenching (cooling) in a bath and ..." to "... materials and ...".
Response: The sentence will be so modified.

k. Appendix F, Page F-2, first paragraph: Correct statements to show that there are two, not three rotary furnaces. There is no need to change calculations to reflect this correction as the ECO is not recommended.
Response: The statements regarding the number of rotary furnaces will be corrected.

l. Appendix I, Page I-3, last sentence on page: Delete entire sentence.
Response: The sentence will be deleted.

m. Appendix J, Page J-1, first paragraph: Modify second sentence from "... water to washout lances at the washout steamout tables in building 117-6 ..." to "... water to hydraulic cleaning equipment in the South Tower in Building 117-6 ...".
Response: The sentence will be so modified.

n. Appendix J, Page J-1, pump data: Modify pump data provided to clarify that the pump heads have been modified to produce 13,000 psig water.
Response: The pump data and descriptions will be so modified.

6. Mr. Justus requested that two (2) additional copies of the Final Submittal and Funding Documents be provided to HAAP. Keller & Gannon agreed to do so.

7. Funding request documents will be provided with the Final Submittal, the next submittal due for the subject project. Attendees discussed the funding programs available (principally, FEMP and ECIP). It was agreed that funding request documents to be prepared for the Final Submittal shall be prepared for FEMP funding. Mr. Justus will contact K&G (through Mr. Azares) within one work-week to request either a single funding request package (over $1 million, requiring preparation of DD Forms 1391) or separate smaller funding request packages (each less than $1 million, allowed on DA Forms 4283, Facility Engineering Work Requests).

Blair I. Horst

BIH:bih
16-403-16

Copy without Attachments to:

Mr. Alex Azares
CESPK-ED-M/ISS
Corps of Engineers, Sacramento District

DATE SENT: 2-16-95
TIME SENT: 3:00 PM
PROJECT No.:
ORIGINAL: JMR /FILE
COPY:

KELLER & GANNON
Engineers & Architects
Quality Services Since 1941

TELECOPY COVER SHEET

DATE: 16 February 1995

TIME: 1500

NUMBER OF PAGES INCLUDING THIS COVER SHEET: 5

TO:	Mr. Alex Azares
COMPANY:	CESPK-ED-M (Army/ISS)
TELECOPY NUMBER:	916-557-7850
FROM:	R. C. Lennig
SUBJECT:	EEAP Energy Survey of WADF, Hawthorne AAP, Nevada
PROJECT NO.	16-403-16
ENCLOSURES:	Responses to Review Comments on Interim Submittal

COMMENTS: Attached are Keller&Gannon responses to review comments received to date on the Interim Submittal of the EEAP Energy Survey of the Western Area Demilitarization Facility at Hawthorne Army Ammunition Plant, Nevada. We plan to enter these responses into the Sacramento District ARMS.

Signature: Richard C. Lennig

1453 Mission Street, San Francisco, California 94103
Phone: (415) 621-1199 FAX: (415) 864-3681
Mail: P.O. Box 422430, San Francisco, CA 94142-2430

EEAP Energy Survey of Army Industrial Facilities, Western Area Demilitarization Facility
Hawthorne Army Ammunition Plant, Hawthorne, Nevada
Responses to Review Comments on Interim Submittal

Reviewer: Robert S. Woodruff, Section EN-DM via Tony Battaglia, CESAM-ED-M 17 January 1995

Comment Number	Page/ Reference	Comment	K&G Response	Response Location
1	Page 4-2	All energy related units should be in kWHrs, MWHrs or MBTU's instead of Joules.	**Done.** All references to values expressed using Joules will be deleted.	Page 4-2
2	Page 4-2	Please clarify the meaning of the statement, "Cost estimates may be considered at an order-of-magnitude level of accuracy."	**Done.** The accuracy of cost estimates prepared for this study is further clarified.	Page 4-2
3	Page 4-3 Para 4.5.1.1	Would it be possible to insulate the industrial buildings with finished panels that have hard surfaces?	**Done.** Prefinished metal panel type insulation would be feasible. An analysis is provided and shows that such retrofits are not economic.	Appendix D Mod to Para 4.5.1.1
4	Page 4-3 Para 4.5.1.2	The retrofit of the air curtains is really a safety issue and should be presented to those in charge of safety.	**Done.** Air curtains are energy saving devices. Selection of air curtains over strip curtains is a safety issue explained by WADF personnel to the A-E. DEH is aware of the safety problems with strip curtains.	No Changes Made
5	Page 4-4 Para 4.5.2.1	Do the new DDC controls need to be explosion-proof?	**Done.** DDC control components installed in explosive environments (work rooms) must be explosion proof/intrinsically safe. However, the design calls only for sensors to be installed in these spaces. The sensors are intrinsically safe. Clarification is added.	Mod to Para 4.5.2.1
6	Page 4-9 Para 4.5.6	Are the instrument air compressors big enough to supply the industrial compressed air needs of each facility?	**Done.** Existing instrument air compressors are not of sufficient capacity to serve all compressed air requirements; capacity is available, however, for backup service to allow for safe shutdown of critical activities.	Mod to Para 4.5.6
7	Appendix A Page 2-2 Para 2.2	This paragraph shows the cost of oil at $0.80 per gallon. The other documentation within this report shows the cost to be $0.85 per gallon. Please clarify. See page B-1 for an example of this.	**Not Done.** The paragraph in question is from a Energy Engineering Analysis Program Study and Criteria Review conducted by K&G and submitted in December 1993 and includes discussions of energy prices at that time. Appendix B addresses present pricing used in the subject Interim Submittal, dated December 1994, a year later than the Criteria Review.	No Changes Made
8	Appendix A Table 3-1	Was ECO No. 8 actually studied?	**Done.** Yes, this ECO was considered. Please refer to Appendix I for detailed calculations. The concepts of reducing the air pressure and increasing storage volume were found not technically feasible. This will be clarified in the report.	Appendix I Text Changes
9	Appendix C Page C-2	How was the amount of steam lost to leakage calculated? Show sample calculation.	**Done.** Steam leakage rates were determined by makeup water requirements during non-load operating periods. Detailed calculations and backup data are provided in Volume II, Appendix E.	Note added to Page C-2
10	Appendix D Page D-3	The paragraph at the top of the page states that operating cost of air curtains are minimal. Isn't the operating cost the reason you are not recommending the air curtains?	**Done.** Operating costs referred to are for maintenance and do not include electrical power costs. Electric costs are determined using the Carrier HAP program. Refer to the Life Cycle Cost Analysis Summaries on pages D-34 through D-36; maintenance costs <u>are</u> minimal compared to other costs considered.	No Changes Made

Responses to Review Comments on Interim Submittal, Continued

Reviewer: Anthony Battaglia, CESAM-ED-M (334-690-2618) 19 January 1995

Comment Number	Page/ Reference	Comment	K&G Response	
1	General	Due to changes in the ECIP Guidance since the scope of work for this study was prepared, projects with Savings-to-Investment Rations (SIRs) less than 1.25 should not be recommended for accomplishment. Please revise as needed.	**Done.** All projects with SIRs below 1.25 will not be recommended for implementation for ECIP and/or for FEMP funding.	Tables 4-2 & 4-3 are revised
2	Page 2-2 & Page 2-3	Since the scope of work for this study was prepared, the funding programs available for energy conservation projects have changed. Referring to paragraph 5 of the scope of work, the ECIP program is still viable; the other programs listed have been replaced by the Federal Energy Management Program (FEMP). See page 2 (of these comments - not reproduced here) for description of FEMP projects and documentation. Projects recommended by this study should go into either the ECIP or the FEMP category. Even though this is a departure from the original scope of work; it should not require any additional effort; since the project documentation has not yet been prepared, and the FEMP documentation is simpler than those which it replaces.	**Done.** The descriptive material provided will be incorporated, as appropriate, into the report. Funding documentation will be prepared for programs identified and agreed to at the Interim Submittal review meeting. It is Keller & Gannon's goal to satisfy client needs.	Para 2.3.3 changed some changes also to Para 2.3.2

Reviewer: Manuel Casipit (RV), CASIPIT @ (916) 557-7659 ARMS 3:15:01 pm 6 February 1995

Comment Number	Page/ Reference	Comment	K&G Response	
1	NA	No comment at this time	**Noted.**	Noted
2	Volume 1 Page 4-4	MECHCO-1: Direct Digital Controls (DDC) is not allowed in Army Corps of Engineers Projects. Designers must use HVAC Control Manual, TM 5-815-3.	**Not Done.** The subject DDC Control Retrofit will be submitted for funding under the FEMP program as repair project (per the revised definition of a repair in a Memo dated July 1994 concerning AR 420-10). The FEMP program is O&M funding, not an MCA funding source where selection of DDC Controls is restricted.	No Changes Made
3	Volume 2 All	MECHCO-2: All equipment proposals must show three manufacturers of similar equipment for each type of equipment proposed. Reference A-E Guide page III-43, Para 3.9.2.2. Suggest Guide be reviewed by A-E(s).	**Not Done.** The A-E Guide has been reviewed by the A-E. CHAPTER III, SECTION 3 of the US Army Corps of Engineers Sacramento District A-E Guide for Army Projects addresses Final Design of projects. This project is a study, not a final design.	No changes made
4	Volume 2 Appendix F	MECHCO-3: Insulation Repair: Verify that none of the existing insulation is an asbestos product, as this would substantially increase the cost of repair or replacement.	**Done.** None of the insulation repairs addressed by recommended insulation projects in this study involves asbestos materials. Clarification will be provided.	Page F-5 & Para 4.5.4
5	Volume 2 Appendix K	MECHCO-4: Must use Army Manual TM 5-785 for design weather data.	**Done. HVAC simulations conducted using** the Carrier HAP program require weather data from computer files available. Results are adjusted for local (Hawthorne, Nevada) data from TM 5-785. Refer to Appendix D, Table D-1 for adjustment factors used for heating and cooling energy use calculations.	Page K-1 note added
6	Volume 1 Appendix E	MECHCO-5: Volume 1, Appendix E, page E-1, second paragraph and Volume 1, page 3-3, paragraph 3.4, indicate three 50,000 PPH coal fired boilers. However Vol. 1, pg 3-1 discusses elec. power & fuel oil supply but says nothing about the coal supply.	**Done.** The three 50,000 PPH coal fired boilers have been mothballed since their initial acceptance testing in the 1970's. Please refer to page 3-3 paragraph 3.4, titled: "Central Steam and Compressed Air Plant Building 117-2", for an explanation. Clarification will be added to the text.	Para 3.2

Responses to Review Comments on Interim Submittal, Continued

Reviewer: Mahlum @ (916) 557-7776 CESPK-CO (Mechanical) (RV) ARMS 3:15:01 pm 6 February 1995

Comment Number	Page/ Reference	Comment	K&G Response	
7	General	MECHCO-6: Why wasn't central steam considered as an energy alternative for building 117-1?	**Not Done.** Building 117-1 is currently served by the central steam plant. Please refer to Figure 3-4 which is a schematic diagram of the steam distribution system at WADF. Building energy sources will be addressed.	Para 3.2

Reviewer: Beltran, CESPK-CO (Electrical) (916) 557-7778 ARMS 3:15:01 pm 6 February 1995

Comment Number	Page/ Reference	Comment	K&G Response	
8	G-1	No comment at this time.	**Noted.**	Noted

Reviewer: Azares, CESPK-ED-M CSS (RV) (916) 557-5126 (GEN) ARMS 3:15:01 pm 6 February 1995

Comment Number	Page/ Reference	Comment	K&G Response	
9	General	Have not received comments from the Installation yet.	**Noted.**	Noted.

Reviewer: Michael Zakshorn, CESPKED-A (RV) (916) 557-7226 (Electrical) ARMS 3:15:01 pm on 6 February 1995

Comment Number	Page/ Reference	Comment	K&G Response	
10	E-6 thru 10	L2EDAMZ9-1: Provode Emergency Lighting in accordance to NFPA 101 in offices, conferences, corridors, labs, class rooms, Auditorium, etc.	**Not Done.** Comment is for a different project.	No changes made
11	General	L2EDAMZ9-2: Penetrations of pipes, conduit, etc., in walls requiring protected openings shall be fire stopped.	**Not Done.** Comment is for a different project.	No changes made
12	Sheets E-6 & E-8	L2EDAMZ9-3: Provide exit signs in accordance to Uniform Building Code 101. Sheets E-6 and E-8, top drawings need an exit sign at the door exiting the building.	**Not Done.** Comment is for a different project.	No changes made
13	General	L2EDAMZ9-4: Emergency system wiring must be kept independent of all other wiring. [NEC 517-30(c)(1)]	**Not Done.** Comment is for a different project.	No changes made
14	General	L2EDAMZ9-5: Provide emergency lighting for building egress in accordance to Uniform Building Code 101. Wall mounted emergency lights with battery packs are no longer authorized; ref 91-5, dtd 18 June 91. Overhead fluorescent lighting fixtures will have built-in emergency lighting.	**Not Done.** Comment is for a different project.	No changes made
15	General	L2EDAMZ9-6: Emergency strobe lights are required by ADA (Americans with Disabilities Act) in toilet rooms.	**Not Done.** Comment is for a different project.	No changes made
16	General	L2EDAMZ9-7: Conduct fault calculations to assure proper withstand ratings for all protective devices. Ensure coordination for all protection devices, conductors, enclosures, and equipment. Show fault calculations in the Design Analysis, and provide fault ratings on equipment (panels, etc.) in the design.	**Not Done.** Comment is for a different project.	No changes made
17	General	L2EDAMZ9-8: Show AIC ratings on new panels and panels to remain.	**Not Done.** Comment is for a different project.	No changes made
18	General	L2EDAMZ9-9: Provide manufacturers name and model number of existing panels to remain.	**Not Done.** Comment is for a different project.	No changes made

Responses to Review Comments on Interim Submittal, Continued

Reviewer: Michael Zakshorn, CESPKED-A (RV) (916) 557-7226 (Electrical) ARMS 3:15:01 pm on 6 February 1995

Comment Number	Page/ Reference	Comment	K&G Response	
19	E-1	L2EDAMZ9-10: Fixture schedule - use Corps of Engineers, Department of the Army, STD. 40-06-04. Provide fixture type and sheet # it is located on. Also provide STD. 40-06-04 cut sheets at the end of 16415 specifications.	**Not Done.** Comment is for a different project.	No changes made
20	General	L2EDAMZ9-11: Fire Alarm pull stations shall be spaced at no more than 200 feet horizontal distance apart unless NFPA 101 (13-3.4.2) is complied with. [NFPA 101 (7-6.2.4)]	**Not Done.** Comment is for a different project.	No changes made
21	General	L2EDAMZ9-12: No new telephone installation was shown on the drawings as mentioned in the design analysis. Please provide.	**Not Done.** Comment is for a different project.	No changes made
22	E-2 thru E-9	L2EDAMZ9-13: Please define electrical service attachment (???) to building. Referring to the triangle located on the lower right hand corner of the building.	**Not Done.** Comment is for a different project.	No changes made
23	E-1	L2EDAMZ9-14: Show demolition work for exterior overhead distribution.	**Not Done.** Comment is for a different project.	No changes made

FACSIMILE HEADER SHEET

COMMAND/OFFICE	NAME/OFFICE SYMBOL	OFFICE PHONE	FAX
From: USAED Mobile, AL	Tony Battaglia CESAM-EN-DM	(334) 690-2618	(334) 690-2424
To: USAED Sacramento, CA	Alex Azares CESPK-ED-M	(916) 557-5126	(916) 557-7850

CLASS	PREC	PAGES	DATE-TIME	MO	YR	RELEASER'S SIGNATURE
U	N	4	19 1400	01	95	Anthony W. Battaglia

REMARKS

space below for communications center use only

Alex:

Attached are the Mobile District comments on the interim submittal of the Industrial Facility Survey for the WADF at Hawthorne AAP.

Tony B.

C:\MMAII\EEAPMM\HWAAPINT.doc

MOBILE DIST. OFFICE PROJECT REVIEW COMMENTS	DATE: 17 Jan 95	PAGE 1 of 1
TO: Army Corps of Engineers Sacramento District	FROM: (Section): EN-DM (Reviewer): Robert S. Woodruff	
PROJECT: Energy Engineering Analysis Program LOCATION: Hawthorne A.A.P., Nevada	Year:	Line Item No.:

Type of Action: Interim Submittal

Item No.	Drawing No. Or Par. No.	COMMENTS	Review Action
1.	Page 4-2	All energy related units should be in KWhrs, MWhrs or MBTU's instead of Joules.	
2.	Page 4-2	Please clarify the meaning of the statement " Cost estimates may be considered at an order-of-magnitude level of accuracy."	
3.	Page 4-3 Para. 4.5. 1.1	Would it be possible to insulate the industrial buildings with finished panels that have hard surfaces?	
4.	Page 4-3 Para. 4.5. 1.2	The retrofit of the air curtains is really a safety issue and should be presented to those in charge of safety.	
5.	Page 4-4 Para. 4.5. 2.1	Do the new DDC controls need to be explosion-proof ?	
	Page 4-9 Para. 4.5. 6	Are the instrument air compressors big enough to supply the industrial compressed air needs of each facility ?	
7.	App."A" Page 2-2 Para. 2.3	This paragraph shows the cost of oil at $ .80 per gallon. The other documentation within this report shows the cost to be $ .85 per gallon. Please clarify See page B-1 for an example of this.	
8.	App. "A" Table 3-1	Was ECO No. 8 actually studied ?	
9.	APP. "C" Page C-2	How was the amount of steam lost to leakage calculated? Show sample calculation.	
10.	App. "D" Page D-3	The paragraph at the top of the page states that operating cost of air curtains are minimal. Isn't the operating cost the reason you are not recommending the air curtains ?	

MOBILE DISTRICT PROJECT REVIEW COMMENTS		Date: 19 Jan 95	Page 1 of 2
To: Alex Azares Sacramento District, CESPK-ED-M	From: (Section) CESAM-EN-DM (Reviewer) A. Battaglia 334-690-2618		
Project: FY93 Industrial Facility Survey, WADF Location: Hawthorne AAP, Nevada	Year: FY-93	Line Item No.:	
Type of Action: Interim Submittal Review			

ITEM NO.	DRAWING NO. OR PAR. NO.	COMMENTS	REVIEW ACTION
1.	General	Due to changes in the ECIP Guidance since the scope of work for this study was prepared, projects with Savings-to-Investment Ratios (SIRs) less than 1.35 should not be recommended for accomplishment. Please revise as needed.	
2.	Page 2-2 & 2-3	Since the scope of work for this study was prepared, the funding programs available for energy conservation projects have changed. Referring to paragraph 5 of the scope of work, the ECIP program is still viable; the other programs listed have been replaced by the Federal Energy Management Program (FEMP). See page 2 for description of FEMP projects and documentation. Projects recommended by this study should go into either the ECIP or the FEMP category. Even though this is a departure from the original scope of work, it should not require any additional effort; since the project documentation has not yet been prepared, and the FEMP documentation is simpler than those which it replaces.	

C:\MMAII\EEAPMM\HWAAPINT.doc

5. PROJECT DOCUMENTATION. ...

5.1 ECIP Projects. ...

5.2 Non-ECIP Projects. ...Projects or ECOs in this category ...shall be provided with the following documentation: the life cycle cost analysis (LCCA) summary sheet completely filled out, a description of the work to be accomplished, backup data for the LCCA, ie, energy savings calculations and cost estimate(s), and the simple payback period. The energy savings for projects consisting of multiple ECOs must take into account the synergistic effects of the individual ECOs. In addition these projects shall have the necessary documentation prepared, as required by the Government's representative, for one of the following categories:

a. Federal Energy Management Program (FEMP) Projects. A FEMP (or O&M Energy) project is one that results in needed maintenance or repair to an existing facility, or replaces a failed or failing existing facility, and also results in energy savings. The criteria are similar to the criteria for ECIP projects, ie, SIR $\geq$ 1.25, and simple payback period of less than ten years. Projects with a construction cost estimate up to $1,000,000 shall be documented as outlined in par 5.2 above; projects over $1,000,000 shall be documented on 1391s. In the FEMP program, a system may be defined as "failed or failing" if it is inefficient or technically obsolete. However, if this strategy is used to justify a proposed project, the equipment to be replaced must have been in use for at least three years.

b. Low Cost/No Cost Projects. These are projects which the Director of Public Works (DPW) can perform using his resources. Documentation shall be as required by the DPW.

Project: 9615 - EEAP WADP at HAWTHORNE AAP, NV

Review: INTERIM REPORT

Num	Name	Office	Page/Sheet	Discipline	Rm/Detail
1	CASIPIT - 1		GEN-0	MEC	

Manuel Casipit (RV), CASIPIT @ (916) 557-7659
>No comment at this time.
A/E Response: Done
> Info.

Num	Name	Office	Page/Sheet	Discipline	Rm/Detail
2	MECHCO - 1	CESPK-COQA	VOL1-4-4	MEC	

CESPK-CO (Mechanical) (RV), MAHLUM @ (916) 557-7776
>Direct Digital Controls (DDC) is not allowed in Army Corps of Engineers
>Projects. Designers must use the HVAC Control Manual, TM 5-815-3.
A/E Response: Not Done
> Not Done. The subject DDC Control
> Retrofit will be submitted for funding
> under the FEMP program as a repair
> project (per the revised definition of
> a repair in a memo dated July 1994
> concerning AR 420-10). The FEMP program
> is O&M funding, not an MCA funding
> source where selection of DDC controls
> is restricted.

Num	Name	Office	Page/Sheet	Discipline	Rm/Detail
3	MECHCO - 2		VOL2-ALL	MEC	

CESPK-CO (Mechanical) (RV), MAHLUM @ (916) 557-7776
>All equipment proposals must show three manufacturers of similar equipment
>for each type of equipment proposed. Reference A-E Guide page III-43, Para
>3.9.2.2. Suggest Guide be reviewed by A-E(s).
A/E Response: Not Done
> Not Done. The A-E Guide has been
> reviewed by the A-E. Chapter III,
> Section 3 of the U.S. Army Corps of
> Engineers Sacramento District A-E Guide
> for Army projects addresses Final
> Design of projects. This project is a
> study, not a final design.

Num	Name	Office	Page/Sheet	Discipline	Rm/Detail
4	MECHCO - 3		VOL2-APPENDF	MEC	

CESPK-CO (Mechanical) (RV), MAHLUM @ (916) 557-7776
>Insulation repair: Verify that none of the existing insulation is an asbestos
>product, as this would substantially increase the cost of repair or
>replacement.
A/E Response: Done
> Done. None of the insulation repairs
> addressed by recommended insulation
> projects in this study involves
> asbestos materials. Clarification will
> be provided.

Num	Name	Office	Page/Sheet	Discipline	Rm/Detail
5	MECHCO - 4		VOL2-APPENDK	MEC	

CESPK-CO (Mechanical) (RV), MAHLUM @ (916) 557-7776
>Must use Army Manual TM 5-785 for design weather data.
A/E Response: Done

Project: 9615 - EEAP WADP at HAWTHORNE AAP, NV

Review: INTERIM REPORT

Num	Name	Office	Page/Sheet	Discipline	Rm/Detail

> Done. HVAC simulations conducted using
> the Carrier HAP program required
> weather data from computer files
> available. Results are adjusted for
> local (Hawthorne, NV) data from TM
> 5-785. Refer to Appendix D, Table D-1
> for adjustment factors used for heating
> and cooling energy use calculations.

---

6 MECHCO - 5 VOL2-APPENDE MEC
CESPK-CO (Mechanical) (RV), MAHLUM @ (916) 557-7776
>Vol 1, Appendix E, page E-1, second paragraph and VOL 1, page 3-3,para. 3.4,
>indicate three 50,000 PPH coal fired boilers. However VOL 1, page 3-1
>discusses electrical power and fuel oil supply but says nothing about the
>coal supply.
A/E Response: Done
> Done. The three 50,000 PPH coal fired
> boilers have been mothballed since
> their initial acceptance testing in the
> 1970's. Please refer to page 3-3,
> paragraph 3.4 titled "Central Steam and
> Compressed Air Plant Building 117-2"
> for an explanation. Clarification will
> be added to the text.

---

7 MECHCO - 6 STUDY-GEN MEC
CESPK-CO (Mechanical) (RV), MAHLUM @ (916) 557-7776
>Why wasn't central steam considered as an energy alternative for building
>117-1?
A/E Response: Not Done
> Not Done. Building 117-1 is currently
> served by the central steam plant.
> Please refer to Figure 3-4 which is a
> schematic diagram of the steam
> distribution system at WADF. Building
> energy sources will be addressed.

---

8 ELECCO - 1 G-1 ELE
CESPK-CO (Electrical) (RV), BELTRAN @ (916) 557-7778
>No comment at this time.
A/E Response: Done
> Info.

---

9 AZARE - 1 GEN GEN
Alex Azares CSS (RV), AZARES @ (916) 557-5126
>Have not received comments from the Installation yet.
A/E Response: Done
> Info.

---

10 L2EDAMZ9 - 1 CESPKED-A E-6 THUR 10 ELE
Michael Zakskorn (RV), ZAKSKORN @ (916)557-7226
>Provide Emergency Lighting in accordance to NFPA 101, in offices,

Project: 9615 - EEAP WADP at HAWTHORNE AAP, NV

Review: INTERIM REPORT

Num Name Office Page/Sheet Discipline Rm/Detail

>conferences, corridors, labs, class rooms, Auditorium, etc.
A/E Response: Not Done
> Not Done. Comment is for a different
> project.

---

11 L2EDAMZ9 - 2 GEN- ELE
Michael Zakskorn (RV), ZAKSKORN @ (916)557-7226
>Penetrations of pipes, conduit, etc., in walls requiring protected openings
>shall be fire stoped.
A/E Response: Not Done
> Not Done. Comment is for a different
> project.

---

12 L2EDAMZ9 - 3 GEN- ELE
Michael Zakskorn (RV), ZAKSKORN @ (916)557-7226
>Provide exit signs in accordance to Uniform Building Code 101. Sheets E-6 and
>8, top drawings need an exit sign at the door exiting the building.
A/E Response: Not Done
> Not Done. Comment is for a different
> project.

---

13 L2EDAMZ9 - 4 GEN- ELE
Michael Zakskorn (RV), ZAKSKORN @ (916)557-7226
>Emergency system wiring must be kept independent of all other wiring. [NEC
>517-30(c)(1)]
A/E Response: Not Done
> Not Done. Comment is for a different
> project.

---

14 L2EDAMZ9 - 5 GEN- ELE
Michael Zakskorn (RV), ZAKSKORN @ (916)557-7226
>Provide emergency lighting for building egress in accordance to Uniform
>Building Code 101. Wall mounted emergency lights with battery packs are no
>longer authorized; ref 91-5, dtd 18 June 91. Overhead florescent lighting
>fixtures will have built-in emergency lighting.
A/E Response: Not Done
> Not Done. Comment is for a different
> project.

---

15 L2EDAMZ9 - 6 GEN- ELE
Michael Zakskorn (RV), ZAKSKORN @ (916)557-7226
>Emergency strobe lights are required by ADA (Americans with Disabilities Act)
>in toilet rooms.
A/E Response: Not Done
> Not Done. Comment is for a different
> project.

---

16 L2EDAMZ9 - 7 GEN- ELE
Michael Zakskorn (RV), ZAKSKORN @ (916)557-7226
>Conduct fault calculations to assure proper withstand ratings for all
>protective devices. Ensure coordination for all protection devices,
>conductors, enclosures, and equipment. Show fault calculations in the Design

Project: 9615 - EEAP WADP at HAWTHORNE AAP, NV

Review: INTERIM REPORT

Num	Name	Office	Page/Sheet	Discipline	Rm/Detail

>Analysis, and provide fault ratings on equipment (panels, etc.) in the
>design.
A/E Response: Not Done
> Not Done. Comment is for a different
> project.

---

17 L2EDAMZ9 - 8 GEN- ELE
Michael Zakskorn (RV), ZAKSKORN @ (916)557-7226
>Show AIC ratings on new panels and panels to remain.
A/E Response: Not Done
> Not Done. Comment is for a different
> project.

---

18 L2EDAMZ9 - 9 GEN- ELE
Michael Zakskorn (RV), ZAKSKORN @ (916)557-7226
>Provide manufacturers name and model number of existing panels to remain.
A/E Response: Not Done
> Not Done. Comment is for a different
> project.

---

19 L2EDAMZ9 - 10 E-1 ELE
Michael Zakskorn (RV), ZAKSKORN @ (916)557-7226
>Fixture schedule - use Corps of Engineers, Department of the Army, STD.
>40-06-04. Provide fixture type and sheet # it is located on. Also provide
>STD. 40-06-04 cut sheets at the end of 16415 specifications.
A/E Response: Not Done
> Not Done. Comment is for a different
> project.

---

20 L2EDAMZ9 - 11 GEN- ELE
Michael Zakskorn (RV), ZAKSKORN @ (916)557-7226
>Fire Alarm pull stations shall be spaced at no more than 200 Feet horizontal
>distance apart unless NFPA 101(13-3.4.2) is complied with. [NFPA
>101(7-6.2.4)]
A/E Response: Not Done
> Not Done. Comment is for a different
> project.

---

21 L2EDAMZ9 - 12 GEN- ELE
Michael Zakskorn (RV), ZAKSKORN @ (916)557-7226
>No new telephone installation was shown on the drawings as mentioned in the
>design analysis. Please provide.
A/E Response: Not Done
> Not Done. Comment is for a different
> project.

---

22 L2EDAMZ9 - 13 E-2 THRU 9 ELE
Michael Zakskorn (RV), ZAKSKORN @ (916)557-7226
>Please define electrical service attachment (???) to building. Referring to
>the triangle located on the lower right hand corner of the building.
A/E Response: Not Done
> Not Done. Comment is for a different

Project: 9615 - EEAP WADP at HAWTHORNE AAP, NV

Review: INTERIM REPORT

Num	Name	Office	Page/Sheet	Discipline	Rm/Detail
> project.					
23	L2EDAMZ9 - 14		E-1	ELE	

Michael Zakskorn (RV), ZAKSKORN @ (916)557-7226
>Show demolition work for exterior overhead distribution.
A/E Response: Not Done
> Not Done. Comment is for a different
> project.

FACSIMILE TRANSMITTAL HEADER SHEET
For use of this form, see AR 25-11: the proponent agency is ODISC4

COMMAND/ OFFICE	NAME/ OFFICE SYMBOL	OFFICE TELEPHONE NO. (AUTOVON/Comm.)	FAX NO. (AUTOVON/Comm.)
FROM: USAED MOBILE, AL	A. BATTAGLIA CESAM-EN-DM	(~~205~~) 334 690-2618	(~~205~~) 334 690-2424
TO: Keller & Gannon San Francisco, CA	Blair Horst	(415) 621-1199	(415) 864-3681

CLASSIFICATION	PRECEDENCE	NO. PAGES (Including this Header)	DATE-TIME	MONTH	YEAR	RELEASER'S SIGNATURE
U	N	5	9 1230	02	95	Anthony W. Battaglia

REMARKS

Space Below For Communications Center Use Only

DA FORM 3918-R, JUL 90 DA FORM 3918-R, AUG 72 IS OBSOLETE

Blair,

The change to AR 420-10 that we discussed on the phone this morning is attached. Please call if you have any trouble reading.

DATE REC'D: 02/09/95
TIME REC'D: 10.45 am
PROJECT No.:
ORIGINAL: BH /FILE
COPY: TMR

UNCLASSIFIED

01 04 1116002 JUL 94 PP PP UUUU. ZYUW

DIR DAIM-FDF/FT BELVOIR VA//DAIM-FDF-B//

AIG 11727

INFO DIR CECPW/FT BELVOIR VA//CECPW-OC//

CDR USACE WASH DC//CEMP-CI//

HQDA WASH DC//DASA-IH//

UNCLAS

FUTURE CHANGE TO AR 420-10 DATED 2 JULY 1987

1. PURPOSE: THE PURPOSE OF THIS MESSAGE IS TO PROVIDE NEW INTERPRETATIONS ON THE DEFINITION OF REPAIR AS DEFINED BELOW IN PARA 2C (ENERGY CONSERVATION MEASURES FOR UTILITY SYSTEMS) AND PARA 2D (RELOCATION AND RECONFIGURATION OF BUILDING COMPONENTS AND UTILITY SYSTEMS).

EFFECTIVE UPON RECEIPT OF THIS MESSAGE AND PENDING ISSUANCE OF AN INTERIM CHANGE, AR 420-10 IS REVISED AS FOLLOWS:

IN SECTION 2, TERMS, DELETE THE REPAIR DEFINITION AND SUBSTITUTE THE FOLLOWING DEFINITION:

REPAIR:

A. THE RESTORATION OF A RPF TO SUCH CONDITION THAT IT MAY EFFECTIVELY BE USED FOR ITS DESIGNATED FUNCTIONAL PURPOSE. REPAIR MAY BE OVERHAUL, REPROCESSING, OR REPLACEMENT OF DETERIORATED

R.S. Russo

R.S. RUSSO/CH/DAIM-FDF-B/3550150

UNCLASSIFIED

02 04 111G00Z JUL 94 PP PP UUUU ZYUW

NO

COMPONENTS PARTS OR MATERIALS.

B. CORRECTION OF DEFICIENCIES IN FAILED OR FAILING COMPONENTS OF EXISTING FACILITIES OR SYSTEMS TO MEET CURRENT ARMY STANDARDS AND CODES WHERE SUCH WORK, FOR REASONS OF ECONOMY, SHOULD BE DONE CONCURRENTLY WITH RESTORATION OF FAILED OR FAILING COMPONENTS. CORRECTIVE WORK MAY INVOLVE INCIDENTAL INCREASES IN QUANTITIES OR CAPACITIES.

C. A UTILITY SYSTEM OR COMPONENT MAY BE CONSIDERED "FAILING" IF, IT IS ENERGY INEFFICIENT, OR TECHNOLOGICALLY OBSOLETE, PROVIDED:

(1) THE UTILITY SYSTEM OR COMPONENT OF SUCH A SYSTEM EXISTS AND IS, IN FACT, ENERGY INEFFICIENT OR TECHNOLOGICALLY OBSOLETE.

(2) THE SYSTEM/COMPONENT TO BE REPLACED HAS BEEN IN SERVICE FOR A MINIMUM OF 3 YEARS.

(3) THE PROJECT IS ESTIMATED TO HAVE A PAYBACK PERIOD OF 10 YEARS OR LESS.

D. MAJOR WORK REQUIRED TO RESTORE A GENERALLY DETERIORATED FACILITY TO SUCH A CONDITION THAT IT MAY BE EFFECTIVELY USED FOR ITS DESIGNATED PURPOSE.

(1) SUCH AN UNDERTAKING MAY INCLUDE, UNDER THE CLASSIFICATION OF REPAIR, THE RELOCATION OR RECONFIGURATION OF

L.S. RUSSO/CH/DAIM-FDF-B/3550150

03 C4 1116002 JUL 94 PP PP UUUU ZYUW

BUILDING COMPONENTS SUCH AS PARTITIONS, WINDOWS, AND DOORS, TO THE EXTENT THAT THEY ARE REPLACEMENTS OF EXISTING COMPONENTS. ADDITIONAL QUANTITIES, BEYOND WHAT EXISTED IS CONSTRUCTION.

(2) SUCH AN UNDERTAKING MAY INCLUDE, UNDER THE CLASSIFICATION OF REPAIR, THE RELOCATION AND RECONFIGURATION OF UTILITY SYSTEMS INTO ARRANGEMENTS TO MEET CURRENT STANDARDS TO THE EXTENT THAT THE TOTAL AREA OR POPULATION SERVED BY THE UTILITY SYSTEM BEING REPLACED IS NOT INCREASED. AN INCREASE IN TOTAL AREA OR POPULATION SERVED IS CONSTRUCTION.

(3) IN CASE OF FAILED OR FAILING SYSTEMS, SUCH AN UNDERTAKING MAY ALSO INCORPORATE ADDITIONAL COMPONENTS, IF BASED ON GOOD ENGINEERING PRACTICE, TO PERMIT THE EFFICIENT AND SAFE USE OF REPLACEMENT SYSTEM.

(4) REPAIR DOES NOT INCLUDE INCREASES IN QUANTITIES OF COMPONENTS FOR FUNCTIONAL REASONS, NOR EXTENSION OF UTILITIES OR PROTECTIVE SYSTEMS TO AREAS NOT PREVIOUSLY SERVED. AN INCREASE IN QUANTITIES OF COMPONENTS FOR FUNCTIONAL REASONS, AREAS NOT PREVIOUSLY SERVED BY UTILITIES OR PROTECTIVE SYSTEMS, OR INCREASES IN EXTERIOR BUILDING DIMENSIONS, IS CONSTRUCTION.

E. COMPLETE REPLACEMENT OF A RPF IS CONSTRUCTION, NOT REPAIR.

T. RUSSO/CH/DAIM-FDF-B/3550150

UNCLASSIFIED

04 04 1116002 JUL 94 PP PP UUUU ZYUW

NO

3. ANY QUESTIONS ON THE ABOVE CHANGES SHOULD BE REFERRED TO DAIM-FDF-B, MR. R. S. RUSSO; (703) 355-0150 OR DSN 345-0150.

R.S. RUSSO/CH/DAIM-FDF-B/3550150

UNCLASSIFIED 111600ZJUL94

APPENDIX B

Utility Rate Schedules

APPENDIX B
Table of Contents

Energy Costs and Life Cycle Cost Analysis Factors

Electricity Costs

Electric Power Costs

Hawthorne Ammunition Plant is provided electric power by Sierra Pacific Power Company under Rate Schedule E93. A copy of Rate Schedule R-1 is attached, which, according to the Sierra Pacific Power Company, is the same as Rate Schedule E93.

Energy	($/kWH)	$0.0438			
Demand	($/kW-Month)	$8.517	=	$102.21	/kW-year

No. 2 Fuel Oil (Distillate) Cost

Fuel pricing is based on the most recent voucher to Carson Valley Oil Company, attached.

Cost per Gallon:	$0.850	=	$6.128	per Million BTUs

Life Cycle Cost Analysis Discount Factors

NISTIR 85-3273-9 Used for Discount Factors: October 1994, Census Region 4, Industrial

Electricity UPV	10 year =	8.58	15 Year =	12.02	20 Year =	15.08
Distillate Fuels UPV	10 year =	9.62	15 Year =	14.23	20 Year =	18.57
Non-Energy UPV	10 year =	8.53	15 Year =	11.94	20 Year =	14.88

SPW year	1	0.971
	2	0.943
	3	0.915
	4	0.888
	5	0.863
	6	0.837
	7	0.813
	8	0.789
	9	0.766
	10	0.744
	11	0.722
	12	0.701
	13	0.681
	14	0.661
	15	0.642
	16	0.623
	17	0.605
	18	0.587
	19	0.570
	20	0.554

Energy Costs and Life Cycle Cost Analysis Factors

Development of Electricity Costs for Analyses

Base Prices per Sierra Pacific Power Company Rate Schedule R-1

	Base		Adjustment	Revised Prices
Customer Charge	$1,247	per Month	none	
Demand Charge	$8.74	per kW per Month	($0.2229)	$8.51713
Energy Charge	$0.04484	per kWH	($0.0011)	$0.04375

Adjustments to these prices are made as follows:

Fuel Adjustment

Month	**Fuel Adjustment projected for 1995 ($ per kWH)**
January	0.00220
February	(0.00121)
March	(0.00118)
April	0.00022
May	0.00031
June	(0.00050)
July	(0.00027)
August	0.00217
September	(0.00140)
October	0.00033
November	(0.00018)
December	0.00019
Average	**0.00006**

Power Factor Adjustment

Power factor adjustment is applied to both the energy and demand charges:

0.15% cost adjustment per % above or below power factor of 80%.
Hawthorne has capacitor banks to correct the power factor. The power factor is maintained at about 97%, continuously. Thus, the price reduction is:

(97% - 80%) x 0.15% = 2.550% reduction in demand and usage charges.

Sierra Pacific
POWER COMPANY

MEMORANDUM

Post-it™ brand fax transmittal memo 7671 | # of pages ▸ 6

To Blair Horst	From Greg Lambert
Co. Keller & Gannon	Co. Sierra Pacific
Dept.	Phone # (702) 689-4210
Fax # (415) 864-3681	Fax # (702) 689-4068

DATE: October 26, 1994

TO: Blair Horst, Keller & Gannon

FROM: Greg Lambert

RE: Rate Schedule for Hawthorne Army Ammunition Depot

In response to your request, I am faxing to you a copy of the rate schedules for the Hawthorne Army Ammunition Depot. If you need any additional information, please contact me at the number listed below. If I am not in, you can also contact Tex Barrett who works in our office.

Again, I hope this information is helpful.

DATE REC'D: 10-26-94
TIME REC'D: 9:15 AM
PROJECT No.:
ORIGINAL: BIH /FILE
COPY: TMR

Greg Lambert
Director, Major Accounts
Sierra Pacific Power Company
P.O. Box 101000
Reno, NV 89520-0400

phone: (702) 689-4210
fax: (702) 689-4068

Tex Barrett
Major Accounts Manager
Sierra Pacific Power Company
P.O. Box 10100
Reno, NV 89520-0400

phone: (702) 689-3031
fax: (702) 689-4068

[redacted].AWW

SIERRA PACIFIC POWER COMPANY
FERC ELECTRIC TARIFF
ORIGINAL VOLUME NO. 1

Twenty-Fourth Revised Sheet No. 4
Cancelling Twenty-Third Revised Sheet No. 4

SCHEDULE R-1

RESALE SERVICE

Availability

Service hereunder is available throughout the Company's service areas where there are existing facilities of adequate capacity.

Applicability

This schedule is applicable to electric service supplied and measured at line voltages, 14,000 nominal volts or higher, to investor-owned, cooperatively owned and public-owned utilities for distribution and resale to the general public.

Rate A:

The charges for service of line voltages of 34,500 volts and higher shall consist of a monthly demand charge and energy charge:

	Per Meter Per Month
Customer Charge	$ 1,247.00
Demand Charge All KW of Billing Demand	$ 8.74 per KW
Energy Charge All KWH	$ .04484 per KWH

Rate B:

The charges for service of line voltages less than 34,500 volts shall consist of a monthly demand and energy charge equivalent to the demand and energy charges, respectively, of Rate A above, increased by six percent (6.0%).

Fuel Adjustment

The charges for service above shall be subject to adjustment in accordance with the Fuel Adjustment of the Company's FPC Electric Tariff.

(Continued)

ISSUED BY: Austin W. Stedham, President
ISSUED ON: February 26, 1988

EFFECTIVE: July 1, 1987

SIERRA PACIFIC POWER COMPANY
FPC ELECTRIC TARIFF
ORIGINAL VOLUME NO. 1

2nd Revised Sheet No. 4A
1st Revised Sheet No. 4A

SCHEDULE R-1

RESALE SERVICE
(Continued)

Power Factor

The demand charge and energy charge, respectively, of the rates above shall be decreased or increased, respectively, fifteen-hundredths of one percent (0.15%) for each one percent (1%) that the average power factor of customer's load during the month is more than or less than eighty percent (80%) lagging. The average power factor shall be computed (to the nearest whole percent) from the ratio of total lagging reactive kilovolt-ampere-hours to total kilowatt-hours.

ISSUED BY: JOE L. GREMBAN, PRESIDENT
ISSUED ON:

EFFECTIVE: November 1, 1985

6922/37

SIERRA PACIFIC POWER COMPANY
FERC ELECTRIC TARIFF
ORIGINAL VOLUME NO.

Eighth Revised Sheet No. 5
Cancelling Seventh Revised Sheet No. 5

SCHEDULE R-1

RESALE SERVICE
(Continued)

Minimum Bill

The minimum monthly charge for service hereunder shall be the customer charge plus the demand charge.

Billing Units

A. Measurement

In those instances when delivery line voltages are 60,000 volts or less, units of demand and energy when measured at the line voltage available or measured and compensated as if measured at such line voltages available shall be used for billing purposes.

In those instances where delivery line voltages are above 60,000 nominal volts, units of demand and energy when measured and compensated as if measured at 60,000 nominal volts shall be used for billing purposes.

B. Billing Demand

The billing demand for Total Requirements Customers for any billing period shall be the highest measured demand for the current period. The billing demand for Partial Requirements Customers for any billing period shall be the greater of the measured demand for the current period; or fifty percent (50%) of the highest billing demand established by the Customer during the preceding eleven (11) months.

C. Measured Demand

For the purposes hereof, measured demand shall be defined as the maximum measured fifteen-minute average kilowatt load during the billing period. Where multiple delivery points supply systems which are interconnected or which may be switched to interconnected operation with substantial transfers of power between delivery points, the measured

(Continued)

ISSUED BY: JOE L. GREMBAN, PRESIDENT
ISSUED ON:

EFFECTIVE: November 1, 1985

6922/27

SCHEDULE R-1

TOTAL REQUIREMENTS
RESALE SERVICE
(Continued)

Billing Units (Continued)

C. Measured Demand (Continued)

demand shall be defined as the maximum measured coincidental-fifteen minute average kilowatt load during the billing period of all delivery points supplying such systems.

In instances, however, where the use of energy is intermittent and subject to violent fluctuations, a shorter time interval may be used and the demand determined from special measurements. Also, at the Company's option, a thermal type of demand meter which does not reset after a definite time interval may be used for demand measurement.

Delivery Point

The company will supply, at its expense, one delivery point for each customer served hereunder. Additional delivery points to interconnected systems, if desired by Customer, will be supplied at the expense of Customer.

Contract

A contract will be required as a condition of service hereunder for a minimum term of not less than five (5) years.

Amendments

This rate schedule in all respects shall be and remain subject to any and all lawful amendments or supplements.

General Terms and Conditions

Service supplied hereunder shall be in accordance with the Electric Service Agreement between the Customer and the Company. With exception of specific terms and conditions of this rate schedule and said agreement, the Terms and Conditions of the company's FPC Electric Tariff shall be considered as forming a part of and incorporated in said agreement.

SIERRA PACIFIC POWER COMPANY
FPC ELECTRIC TARIFF
ORIGINAL VOLUME NO. 1

Tenth Revised Sheet No. 15
Cancelling Ninth Revised Sheet No. 15

INDEX OF PURCHASERS

Purchaser	Delivery Point	FPC Electric Tariff Rate Schedule	Delivery Voltage	Purchase Requirements
City of Fallon	Fallon, Nevada	R-1	34,500	Total
Pacific Gas and Electric Company	Echo Summit, Meyers, California	R-1	14,400	Partial
Truckee-Donner Public Utility District	Truckee, California	R-1	60,000	Total (Four delivery points to an interconnected system)
	Donner Lake, California	R-1	60,000	
	Tahoe-Donner, California	R-1	60,000	
	Truckee (Martis Substation), California	R-1	120,000	
Hawthorne Army Ammunition Depot	Hawthorne, Nevada	R-1	55,000	Total (Supported by partial standby)

ISSUED BY: JOE L. GREMBAN, PRESIDENT
ISSUED ON:

EFFECTIVE: December 18, 1985

6922/36

#0214 (10/81)

SIERRA PACIFIC POWER COMPANY
FPC ELECTRIC TARIFF
ORIGINAL VOLUME NO. 1

Tenth Revised Sheet No. 8
Cancelling Ninth Revised Sheet No. 8

FUEL ADJUSTMENT

The monthly charges for service otherwise applicable under each of Company's rate schedules shall be increased or decreased by an adjustment amount in accordance with increases or decreases in the cost of fuels within Company's interconnected system. Estimates of the fuel adjustment factor will be utilized for each billing period and adjusted to actual in the subsequent billing period based on actual cost. The adjustment amount shall be determined by mutiplying the kilowatthours of each billing by the adjustment of A. below.

A. The Energy Charge shall be increased or decreased respectively by the applicable fuel adjustment rate per kilowatthour delivered, which rate shall be equal to:

$$\frac{F_m}{S_m} - \frac{F_b}{S_b} \qquad .947$$

Where "F" is the expense of fossil and nuclear fuel in the base (b) and current (m) periods; and "S" is the kilowatthour sales in the base and current periods, all as defined in Section 35.14 of the Regulations under the Federal Power Act as provided in Order No. 517 issued November 13, 1974 in Docket No. R-479 and .936 is the factor for adjustment of losses.

$$\frac{1.062}{1.122} = \frac{\text{Schedule R Loss Factor}}{\text{System Loss Factor}}$$

F_b = Base energy cost of $.027693 per kilowatthour as determined from fuel costs and kilowatthour sales for the twelve month period ended June 30, 1986.

B. Fuel costs (F) shall be the cost of:

(a) Fossil and nuclear fuel consumed in the Company's own plants, and the Company's share of fossil and nuclear fuel consumed in jointly owned or leased plants.

(b) The actual identifiable fossil and nuclear fuel costs associated with energy purchased by the Company for reasons other than identified in (c) below.

(Continued)

ISSUED BY: JOE L. GREMBAN, PRESIDENT
ISSUED ON:

EFFECTIVE: November 1, 1985

692/8

SIERRA PACIFIC POWER COMPANY
FPC ELECTRIC TARIFF
ORIGINAL VOLUME NO. 1

Sixth Revised Sheet No. 8A
Cancelling Fifth Revised Sheet No. 8A

FUEL ADJUSTMENT
(Continued)

B. (c) The net energy cost of energy purchases, exclusive of capacity or demand charges (irrespective of the designation assigned to such transaction) when such energy is purchased on an economic dispatch basis. Included therein shall be such costs as the charges for economy energy purchases and the charges as a result of scheduled outage, all such kinds of energy being purchased by the buyer to substitute for its own higher cost energy; and less

(d) the cost of fossil and nuclear fuel recovered through inter-system sales including the fuel costs related to economy energy sales and other energy sold on an economic basis.

C. Fuel generation costs shall be priced at the average cost of fuel burned in the current period. The current period is defined as the monthly operating period preceding the month in which the fuel adjustment charge is to be billed.

D. Fuel costs associated with firm purchased power costs shall be priced at the average actual costs experienced in the current period.

E. Economy energy shall be priced at the average actual cost experienced in the current period.

F. Sales (S) shall be all interconnected system kWh's sold, excluding inter-system sales. Where for any reason, billed system sales cannot be coordinated with fuel costs for the billing period, sales shall be equated to the sum of generation, purchases, interchange-in, less energy associated with pumped storage operations, less inter-system sales referred to in (d) above, less total system losses.

G. The factor for adjustment of losses as set forth in A. above shall be calculated based on the same twelve-month operating period utilized in determining base energy cost.

ISSUED BY: JOE L. GREMBAN, PRESIDENT
ISSUED ON:
692/9

EFFECTIVE: May 28, 1982

RATE_t
26-Oct-94 10:08:01

SIERRA PACIFIC POWER COMPANY
ELECTRIC DEPARTMENT - FERC RATES

RATE TABLE

	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
CUSTOMER CHARGE	$1,247.00	$1,247.00	$1,247.00	$1,247.00	$1,247.00	$1,247.00	$1,247.00	$1,247.00	$1,247.00	$1,247.00	$1,247.00	$1,247.00
DEMAND CHARGE	8.74	8.74	8.74	8.74	8.74	8.74	8.74	8.74	8.74	8.74	8.74	8.74
ENERGY CHARGE	0.04484	0.04484	0.04484	0.04484	0.04484	0.04484	0.04484	0.04484	0.04484	0.04484	0.04484	0.04484
BASE FUEL RATE	0.025774	0.025774	0.025774	0.025774	0.025774	0.025774	0.025774	0.025774	0.025774	0.025774	0.025774	0.025774
LOSS ADJ	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.947
FUEL & PUR PWR RECOVERY												
BASE PER kW	4.44	4.44	4.44	4.44	4.44	4.44	4.44	4.44	4.44	4.44	4.44	4.44
BASE PER kWh	0.027517	0.027517	0.027517	0.027517	0.027517	0.027517	0.027517	0.027517	0.027517	0.027517	0.027517	0.027517
1994												
FUEL CLAUSE-CURRENT	-	-	-	-	-	-	-	-	-	-	-	(0.00490)
FUEL CLAUSE-ADJ	-	-	-	-	-	-	-	-	-	-	-	(0.00080)
1995												
FUEL CLAUSE-CURRENT	(0.00256)	(0.00377)	(0.00495)	(0.00473)	(0.00442)	(0.00492)	(0.00519)	(0.00302)	(0.00442)	(0.00409)	(0.00427)	(0.00408)
FUEL CLAUSE-ADJ	0.00220	(0.00121)	(0.00118)	0.00022	0.00031	(0.00050)	(0.00027)	0.00217	(0.00140)	0.00033	(0.00018)	0.00019

Subcontracts (64000)
Travel/Trng (65000)
Utilities (66000)
Mat/Supplies (67000)
Other/Eqpt (69000)

DZB

FINANCIAL VOUCHER

FV NUMBER 94-6072
Date 05 AUG 94
Page 1 of 2

( ) Receivable (XX) Payable

ACCOUNT: (XX) GENERAL ( ) PAYROLL ( ) INS CLAIMS
( ) PLANT MGR ( ) CORPORATE ( ) TPW REG ( ) TPW MM

DEBIT					CREDIT		
P/C	PCN	AC	SUBAC	AMOUNT	AC	SUBAC	AMOUNT
34	59342H	43	6701	20,407.09	40	1101	28,755.88
34	59342H	43	6801	8,348.79			
			TOTAL	28,755.88		TOTAL	28,755.88

~~PAY~~/TO: Carson Valley Oil Company
P.O. Box 643
Carson City, NV 89702-0643

DZB NO. 94-D-1302
REF NO. Acct. #032975

DESCRIPTION	AMOUNT
Diesel Fuel #2 - 33,825 gls See Page 2 (Partial Payment #18)	28,755.88

Prepared by: ma Date 8/3/94
MGR FS DIV: [signature] Date 8/3
DISB OFFICER: mr Date 8-5-94 CK NO 66172
DIR FM: [signature] Date 8/5/94 PV NO HW94-045
FAS Input _____ Date _____

SUB TOTAL	28,755.88
DISCOUNT	
TAX	
SHIPPING	
OTHER	
TOTAL	28,755.88

HWAAP 387 (REV. 9-92)

Subcontract 94-B-1502 - Carson Valley Oil Company (DF-2)

Inv. #	Del. #	Description	Del. Date	Gallons	Unit Price	Subtotal	Fed. Tax.	Superfunds	Sales Tax	Total
68269	035L	Low Sulfur	07/21/94	11,209	0.6004	6,729.88	2,735.00	117.13		9,582.01
68272	036L	Low Sulfur	07/26/94	11,313	0.5944	6,724.45	2,760.37	118.23		9,603.05
68274	037L	Low Sulfur	07/27/94	11,303	0.5923	6,694.77	2,757.93	118.12		9,570.82
										0.00
										0.00
										0.00
										0.00
										0.00
										0.00
										0.00
				TOTAL		20,149.10	8,253.30	353.48	0.00	28,755.88

NOTE: HIGH SULFUR DF-2 IS EXEMPT FROM FEDERAL EXCISE TAX

LOW SULFUR DF-2 IS EXEMPT FROM STATE SALES TAX

APPENDIX C

Simulated Baseline Energy Consumption

APPENDIX C
Table of Contents

Baseline Energy Consumption

No. 2 fuel oil and electricity consumption over the past three years at WADF are summarized on Tables C-1 and C-2. Their respective plots appear as Figure C-1 and C-2.

Simulated energy usage baselines are developed for fuel oil and electricity consumption in order to provide realistic energy consumption levels for economic analyses of energy conservation opportunities (ECOs). The few years of energy consumption records available since WADF has been brought out of mothballs does not represent an adequate baseline against which to compare the energy savings expected from ECOs at a fully functional WADF. Thus, simulated electric power and No. 2 fuel oil baselines are developed. A few assumptions used in these calculations include:

- All WADF buildings are operating
- 100 shiftworkers per day
- Operations 16 hours per day, 6 days per week
- Steam and compressed air leaks are repaired

Historical No. 2 Fuel Oil Consumption

Fuel consumption records available for the WADF central steam plant are summarized on Table C-1 and are plotted on Figure C-1. The plot shows that there is no obvious trend of fuel consumption.

Analysis of energy conservation opportunities which follow indicates that the single greatest consumers of the steam generated in the central plant are distribution system leaks and non-functional condensate return systems.

A reliable historical baseline for fuel oil consumption cannot be established from the few years of operations because building HVAC systems in most of the buildings have not been functioning properly, the operating schedule of WADF has been highly variable, some process systems have been under renovation and several buildings are non-operational. At present, for example, the following facilities are not operating:

Building 117-2 Central Steam Plant	Most not operating
Building 117-4 Bulk Explosives Disposal Building	Non-operational, waiting on modifications to incinerators
Building 117-6 (North Tower) Steamout Building	North tower equipment being installed / modified
Building 117-9 Large Cells Building	Non-operational
Building 117-10 Preparation Building	Non-operational
Building 117-11 Accumulator Building	Non-operational
Building 117-12 Off-Loading Dock	Non-operational
Building 117-13 Magazines Group A	Non-operational
Building 117-14 Magazines Group B	Non-operational
Building 117-15A Antechamber	Decommissioned

The floor area of these building totals 59,250 SF of the total area of 106,765 SF of WADF structures, or 55% of the total WADF building floor area.

Projections of future energy savings developed rely on the assumption that WADF buildings considered will be fully operational. Consequently, a simulated energy usage baseline is developed.

Simulated Baseline Fuel Oil Consumption

No. 2 Fuel Oil is used to generate steam in building 117-2 and is also used for building 117-3, 117-4 and 117-15 processes. Only that portion of fuel oil feeding the steam boiler in building 117-2 is under consideration in this study.

Process Steam Usage and Leakage from Distribution Piping

Leakage constitutes a significant portion of the steam generated in building 117-2. Fuel oil consumption from process steam usage and leakage rates are based on boiler efficiency calculations which consider recorded makeup water and fuel consumption during the non-heating season.

Process Steam:	2,480	Gal/Day x 8.35 Lbs/Gal x (365 - 52) Day/Year =	6,480,509	Lb/Year Stm
Leakage Rate:	4,101	Gal/Day x 8.35 Lbs/Gal x 365 Day/Year =	12,500,129	Lb/Year Stm

Process Steam:	6,481	x 1,000 PPY Stm x (h_v-h_l) + Eff w/o leaks =	**10,928**	**Million BTU/Yr**
Leakage Rate:	12,500	x 1,000 PPY Stm x (h_v-h_l) + Eff w/o leaks =	**21,079**	**Million BTU/Yr**

Baseline HVAC Energy Usage

HVAC uses of No. 2 Fuel Oil are based on "Baseline" simulations of HVAC energy use for model buildings and extensions to similar buildings found in Appendix D, results are:

Building Number	Building (SF)	Electric kWH/Yr	Fuel Oil Million BTU/Yr
Building 117-1	9,181	154,738	905
Building 117-3	13,957	156,938	1,060
Building 117-5	6,439	151,843	4,487
Building 117-4	8,733	105,126	764
Building 117-6	11,780	252,746	7,105
Building 117-8	8,134	91,988	610
Buildings 117-10 & 117-11	11,447	140,555	1,294
Totals (includes leakage)	69,671	1,053,934	16,223
Adjusted Fuel Oil Usage (removing steam leakage)			13,836

Simulated Baseline No. 2 Fuel Oil Usage Summary

Process Steam:	10,928	Million BTU/Yr
Steam Leakage:	21,079	Million BTU/Yr (Refer to Appendix E for leakage calculations)
HVAC Uses:	13,836	Million BTU/Yr
DHW Uses:	0	Million BTU/Yr (Bathing water in bldg 117-1 heated with electricity)
Total Simulated Baseline	45,844	**Million BTU/Yr**
FY94 Fuel Oil Consumption:	38,274	Million BTU/Yr

Steam plant ECOs will save 33,747 Million BTU/Yr, which is almost 90% of the FY94 consumption!
When compared to the simulated baseline, 74% of baseline energy usage is saved. Subtracting the portions of the simulated baseline and energy savings due to repairing leakage, the comparison becomes:

Process Steam:	10,928	Million BTU/Yr
HVAC Uses:	13,836	Million BTU/Yr
DHW Uses:	0	Million BTU/Yr (Bathing water in bldg 117-1 heated with electricity)
Total Simulated Baseline	24,764	**Million BTU/Yr**
FY94 Fuel Oil Consumption:	38,274	Million BTU/Yr

Steam plant ECOs will save 12,668 Million BTU/Yr, which is 51% of the "modified" simulated baseline, and fairly reasonable for the types of ECOs evaluated herein.

Historical Electricity Consumption

Power consumption records available from WADF are summarized on Table C-2 and are plotted on Figure C-2. The plot does not show obvious annual trends of energy consumption because operations are still starting up from the long period during which WADF facilities were "mothballed".

Looking carefully at Figure C-2, however, it appears that summer electrical usage increases in response to additional cooling requirements. This upward movement is seen in each of the three years of data plotted.

Baseline electrical usage is determined below for a fully functioning WADF. The records summarized on Table C-2 and plotted on Figure C-2 are from the last three years with only a few of the WADF facilities operating.

Simulated Baseline Electric Power Consumption

Results of HVAC energy use computer simulations presented in the discussion of fuel oil use are listed in the table below; these values are determined based on simulation results presented in Appendix D.

Simulated Baseline Lighting Electrical Power Consumption

Baseline lighting power usage is addressed in Appendix G. Survey results and calculated building lighting energy use are summarized below.

Simulated Baseline Domestic Water Heating Electrical Power Consumption

Electric power is also used to heat domestic water in processing facility toilets and for the Service and Support Building 117-1 locker room showers. Based on 100 shift workers per day and assuming about 20 gallons per capita-day (gpcd) use of 140°F domestic hot water (DHW), annual electricity usage in building 117-1 is estimated as follows:

20 gpcd x 8.35 Lb/Gal x (140-50) Δ°F x 100 PN x 6 Day/Wk x 52 Wks/Yr ÷ 3,413 BTU/kWH =
137,397 kWH/Yr.

Handwashing in processing building toilet rooms consumes a minor amount of additional electricity. Results shown in the table below are based are portioned based on building floor area, and assume 5 gpcd of hot water consumption overall for the 100 shift workers.

5 gpcd x 8.35 Lb/Gal x (140-50) Δ°F x 100 PN x 6 Day/Wk x 52 Wks/Yr ÷ 3,413 BTU/kWH =
34,349 kWH/Yr.

Simulated Baseline Process Electrical Power Consumption

The major process electricity users are the air compressors in Building 117-2 and the high pressure water pumps located in Building 117-6A. All facilities use some electric power, however, the consumption from these two sources is the most significant. Contributions from other processing facilities are not included.

Based on calculations provided in Appendix I, baseline power consumption by the air compressors located in the central plant building 117-2 consume 184,756 kWH per year, not including losses due to leaks.

High pressure water pumps located in Building 117-6A are estimated to consume about 1,352,872 kWH per year, based on calculations provided in Appendix J.

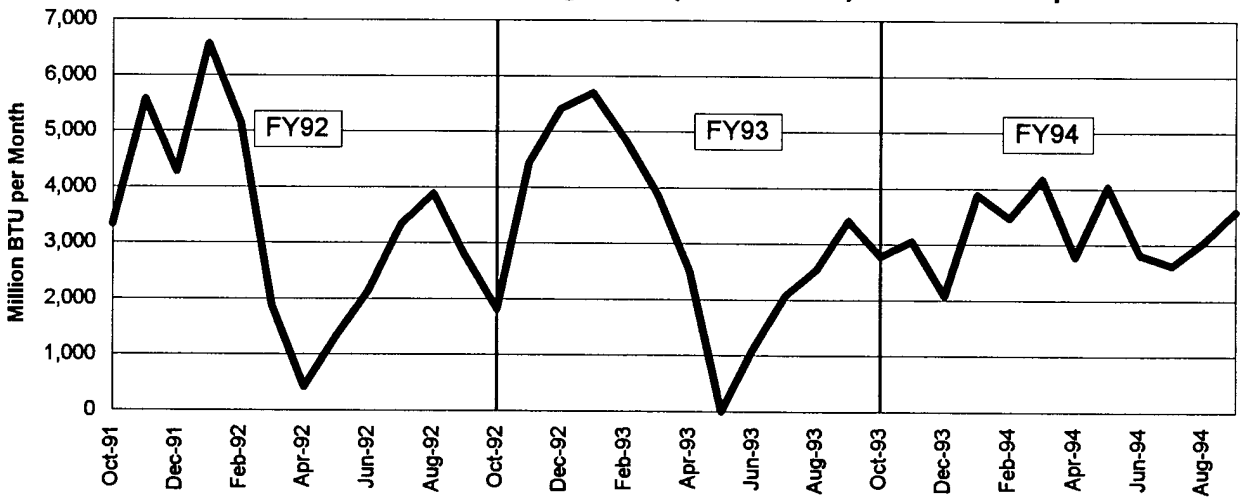
Summary of Simulated Baseline Electricity Usage

Building Number	Building SF	HVAC kWH/Yr	Lighting kWH/Yr	DHW kWH/Yr	Process kWH/Yr	Total kWH/Year
Building 117-1	9,181	154,738	79,148	137,397	0	371,283
Building 117-2 Power Plant (partial)		nil	20,713	0	184,756	205,470
Building 117-3	13,957	156,938	166,104	6,881	0	329,923
Building 117-4	8,733	105,126	92,968	4,306	0	202,399
Building 117-5	6,439	151,843	118,729	3,175	0	273,746
Buildings 117-6 & 6A	11,780	252,746	107,035	5,808	1,352,872	1,718,461
Building 117-7		nic	45,279	0	0	45,279
Building 117-8	8,134	91,988	79,281	4,010	0	175,280
Buildings 117-10 & 117-11	11,447	140,555	190,209	5,644	0	336,408
Building 117-15		nil	15,974	0	0	15,974
Totals	69,671	1,053,934	915,441	167,220	1,537,629	3,674,223

Table C-1. WADF Historical No. 2 Diesel Fuel Oil Consumption

Month/Year	DF-2 Process Usage (Gallons)	(Million BTU)	Month/Year	DF-2 Process Usage (Gallons)	(Million BTU)	Month/Year	DF-2 Process Usage (Gallons)	(Million BTU)
Oct-91	24,000	3,329	Oct-92	13,100	1,817	Oct-93	20,000	2,774
Nov-91	40,100	5,561	Nov-92	32,000	4,438	Nov-93	22,000	3,051
Dec-91	30,800	4,272	Dec-92	39,000	5,409	Dec-93	15,000	2,080
Jan-92	47,260	6,554	Jan-93	41,000	5,686	Jan-94	28,000	3,883
Feb-92	37,000	5,132	Feb-93	35,000	4,854	Feb-94	25,000	3,467
Mar-92	13,500	1,872	Mar-93	28,000	3,883	Mar-94	30,000	4,161
Apr-92	3,000	416	Apr-93	18,000	2,496	Apr-94	20,000	2,774
May-92	9,600	1,331	May-93	0	0	May-94	29,073	4,032
Jun-92	15,400	2,136	Jun-93	8,100	1,123	Jun-94	20,258	2,810
Jul-92	24,000	3,329	Jul-93	15,000	2,080	Jul-94	18,864	2,616
Aug-92	28,000	3,883	Aug-93	18,300	2,538	Aug-94	21,890	3,036
Sep-92	20,000	2,774	Sep-93	24,600	3,412	Sep-94	25,882	3,590
Total FY92	292,660	40,589	Total FY93	272,100	37,738	Total FY94	275,967	38,274

Figure C-1. WADF Building 117-2 (Steam Plant) DF-2 Consumption



F:\PROJ\1640316\ENGR\BASELINE.XLS DF-2 92-94

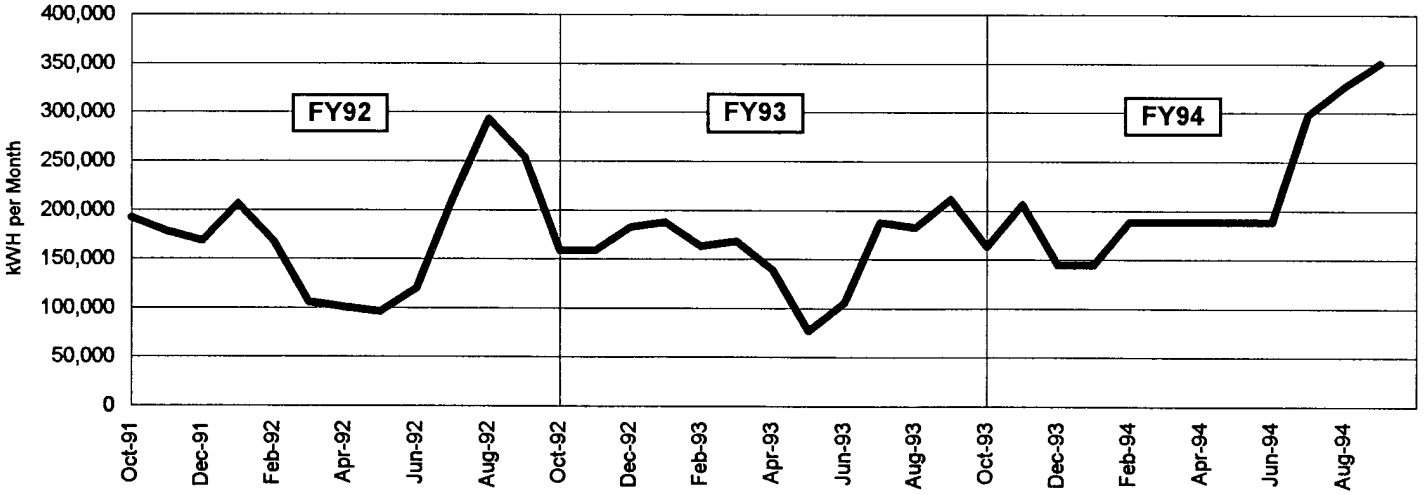
Table C-2. WADF Historical Electricity Consumption

Month/Year	kWH
Oct-91	192,000
Nov-91	177,600
Dec-91	168,000
Jan-92	206,400
Feb-92	168,000
Mar-92	105,600
Apr-92	100,800
May-92	96,000
Jun-92	120,000
Jul-92	211,200
Aug-92	292,800
Sep-92	254,400
Total FY 92	2,092,800

Month/Year	kWH
Oct-92	158,400
Nov-92	158,400
Dec-92	182,400
Jan-93	187,200
Feb-93	163,200
Mar-93	168,000
Apr-93	139,200
May-93	76,800
Jun-93	105,600
Jul-93	187,200
Aug-93	182,400
Sep-93	211,200
Total FY 93	1,920,000

Month/Year	kWH
Oct-93	163,200
Nov-93	206,400
Dec-93	144,000
Jan-94	144,000
Feb-94	188,160
Mar-94	188,160
Apr-94	188,160
May-94	188,160
Jun-94	188,160
Jul-94	297,600
Aug-94	326,400
Sep-94	350,400
Total FY 94	2,572,800

Figure C-2. WADF Historical Electricity Consumption



Note: No meter readings taken in Dec-93, Feb-94, Mar-94, Apr-94 and May-94.

APPENDIX D

Building Envelope and HVAC Controls Retrofit Calculations

APPENDIX D
Table of Contents

Building Envelope & HVAC Controls Retrofit Calculations

Building HVAC system energy saving modifications and repairs investigated include:

- Building envelope modifications (insulation retrofits),
- DDC controls retrofits to replace existing pneumatic controls,
- Installation of air curtains to reduce infiltration from open roll-up doors,
- Heat recovery from exhausted conditioned air, and
- Modify ethylene-glycol pump control to cycle on only when heat is needed.

Energy savings are estimated using Carrier Corporation's Hourly Analysis Program (HAP-30), a computerized HVAC energy use simulation program.

Three representative WADF buildings are modeled; results of these simulations are extended to other WADF buildings. Separate simulations are provided for each functional area of the "model" buildings, including:

- Control Rooms / Office Areas (often including toilets and break rooms),
- Work / Processing Areas, e.g., "Towers" in buildings 117-5 and 117-6, and
- Mechanical Rooms

Results of functional area HVAC energy use simulations are extended to "similar" buildings on a floor area basis separately for each functional area. Calculations are shown on Table D-1. Energy costs and life cycle cost analysis discount factors used for evaluations are shown on Table D-2.

Building Envelope Modifications (Insulation Retrofits)

During field investigations, it was discovered that all non-industrial building areas are already insulated. Insulation includes rigid roof insulation and fiberglass type wall insulation. Industrial type processing areas are not insulated now and should not be insulated on the building interior in the future due to the possibility of contamination by explosive materials. An evaluation of exterior fiberglass batt wall insulation in combination with steel siding for buildings 117-3 and 117-5 yields negative economics, consequently, no additional energy conservation calculations are conducted for insulation retrofits.

DDC Controls Retrofit

All WADF building HVAC systems currently have pneumatic controls. While pneumatic process controls are calibrated periodically, building HVAC system controls, for the most part, are not. This is due to limited maintenance staffing. In addition to uncalibrated controls, several HVAC systems require repairs before they can be operated as designed.

Energy Savings

Energy savings are achievable by installing DDC controls to replace existing pneumatic controls. Some of the features that DDC controls can provide include:

- Heating and cooling supply air temperature reset,
- Proper space temperature control, and
- Night and weekend (scheduled down time) temperature set-back controls.

Energy cost savings are based on energy use simulations, calculations are shown on Table D-1. Electric demand savings of about 7.6 kW are realized by disconecting each instrument air compressor.

Operation & Maintenance Cost Savings

Operation and maintenance costs will be reduced with the utilization of DDC control systems. Calibration is required less frequently than with pneumatic controls. Pneumatic controls must be calibrated at least twice annually; DDC controls require calibration no more than once per year. Additional maintenance is required for pneumatic controls because they are typically less reliable at maintaining setpoints than are DDC controls. Assuming an electrician at $41.58 per hour (location adjusted value from Means '94) requires 2 PN, 8 hours per system for calibrating pneumatic controls and an additional 16 MH per year of miscellaneous maintenance work, and only 2 hours per system to calibrate DDC controls once per year:

(2 pneumatic cals. x 2PN x 8 Hours/calibration + 16 Hours) x $41.58/MH =	$1,996	per year O&M Cost
1 DDC calibration/year x 2 Hours/calibration x $41.58/MH =	$83	per year O&M Cost
O&M Cost Savings per Year per HVAC System	**$1,913**	**per year O&M Cost**

DDC Controls Construction Cost and Investment

Construction costs for DDC controls retrofits and HVAC system repairs are provided on the attached construction cost estimates. The levels of investment required are somewhat misleading as the DDC control costs constitute replacement of an existing, nonfunctional, system by upgrading. As such, the cost of replacing existing nonfunctional pneumatic controls and HVAC system repairs are avoided.

Existing pneumatic control system sensors and control components have been contaminated with plant air, compressed air provided from building 117-2. Instrument air compressors in each mechanical room have been cross-connected with plant air systems. While this appears to make sense, the two compressed air systems operate differently. Instrument Air is dry and oil-free, Plant Air is dry, but contains some oil from the compressors located in building 117-2. This oil has contaminated sensitive sensors and other pneumatic control system components, necessitating their replacement.

Pneumatic control systems, according to Means '94, require similar installation costs to DDC control systems. Materials are about 15% less costly. Avoided costs of repairing pneumatic controls are, thus, the same as costs for DDC controls with reduced materials costs. The same "below-the-line" factors are applied.

Recommended economic analysis life times for ECIP type projects categorized as EMCS or HVAC controls is 10 years according to the latest guidance.

Install Air Curtains on Roll-up Doors

Large doors in most of the industrial facilities must stay open during most of the scheduled operating hours to accommodate movement of materials from one building to another. Conditioned air is lost through the open doors.

Plastic strip curtains were installed on several openings some years ago in an attempt to eliminate infiltration from open doors. While strip curtains are often effective in similar warehousing operations, they have proved ineffective at WADF because they have become contaminated (discolored) with explosives and have created a hazard to forklift operators moving munitions. The hazard is two-fold: visibility is limited due to discoloration caused by contact with explosives particulates and sunlight and the heavy strips hit the forklift operators when they execute turns close to the doorways. In at least one case, a load of munitions was spilled.

Installation of air curtains will perform the same function as plastic strip curtains without the hazards. A continuous, high velocity stream of air is directed from the top to bottom of door openings via special fans. The disadvantage is that power is consumed by the fans. Energy savings from reduced losses of conditioned air is balanced against increased fan electrical energy consumption.

Energy savings are determined using the HAP-30 HVAC Energy Use Simulation computer program. Results

are provided on Table D-1.

Annual operations and maintenance costs are minimal for air curtains. Assume 1/2 hour per year of electrician's time per building to check and/or adjust: 0.5 MH x $41.58/MH = $20.79 /Year

Exhaust Air Heat Recovery

Building exhausts contain conditioned air. Recovery of heat in this exhausted air can be recovered for reuse in conditioning fresh outside air introduced into the buildings.

Several methods are available for recovering thermal energy from air streams. Heat recovery methods include:

- Heat Pipes: Tubular vessels (pipes) containing a refrigerant. One end of the pipe is exposed in an exhaust air stream, the other in a supply air stream. Depending on the tilt of the pipe, refrigerant is evaporated at one side and condensed at the other side, transferring heat via the phase changes. This method is only applicable when the two air streams are in close proximity. This method is not applicable to WADF buildings because of this restriction.
- Thermal Wheels: Metallic surfaces which are exposed to one air stream for a period of time and are then rotated into another air stream, releasing their heat. Thermal wheels must be exposed to both the exhaust and supply air streams, and the air streams must be next to each other. The exhaust air streams in WADF facilities may contain some dust that is explosive (although systems are designed to prevent this from occurring). For this reason - the prevention of contamination of supply air with explosives- thermal wheels have been ruled out as a potential heat recovery method.
- Run-Around Loops: Heat transfer coils are installed at the exhaust and fresh air intakes. Water or a ethylene glycol - water mixture is pumped around the loop, from one coil to another, transferring heat from one air stream to the other. The advantages of this arrangement include non-contamination and the flexibility of serving air streams that may not be located close together. The disadvantage is that the system requires a pump, reducing the amount of energy that may be recovered due to pumping energy requirements.

The third method, run-around loops, is the only heat recovery technology considered that is suitable for application in WADF facilities.

Heat recovery is considered for industrial facilities at WADF, exclusively between work area exhausts and outside air intakes.

Energy savings are determined using the computer HVAC energy use simulation program HAP-30.

Facilities included and the dimensions of their work area exhausts and fresh air intakes are as follows:

Building Number	Exhaust In. x In.	Air Flow CFM	OAS In. x In.	Air Flow CFM	Data Source
117-5	24x48,8EA	1,188 EA	120 x 42	9,500	From As-Built Plans
117-6N	24x48,7EA	1,200 EA	120 x 42	6,300	From As-Built Plans
117-6S	24x48,7EA	1,143 EA	120 x 42	8,000	From As-Built Plans

Facilities which are not included in analyses for exhaust heat recovery and reasons for their exclusions are:

117-1	Exhaust heat recovery not considered; configuration of HVAC system will not easily accommodate required equipment.
117-2	HVAC System is not applicable for heat recovery
117-3	Additional fan energy usage costs exceeds cooling and heating energy cost savings. Process heat recovery for HVAC use is considered separately.
117-6A	Building does not have an air handling system
117-7	Exhaust heat recovery not considered; configuration of HVAC system will not easily accommodate required equipment.
117-8	Configuration similar to Bldg 117-3: N/A
117-10	Configuration similar to Bldg 117-3: N/A
117-11	HVAC System is not applicable for heat recovery
117-15	Building has no HVAC system. Process heat recovery is considered separately.

Operation and maintenance for the coils and circulation pumps will require annual cleaning and preventive maintenance. Assume: 16 MH per year x $42.33/MH plumber per system = $677 per year per system

Modify Ethylene-Glycol Circulation Pump Controls

Circulation pumps located in each WADF mechanical room circulate hot ethylene-glycol through steam heat exchangers to heating coils and convectors serving the building HVAC systems. These pumps remain energized throughout the heating season. Heating to the coils is controlled by three-way valves.

Computer simulations of baseline and DDC control retrofit HVAC system energy consumption include consideration of these pumps; no separate calculations are provided.

It should be noted that the original design and installation of pneumatic control systems include pump cycling with heating demand. These controls do not appear to be functioning properly at this time.

Table D-1.
Energy Conservation Opportunity Evaluations Based on Computerized HVAC Energy Use Simulations

Building Number	Building Area Description	Building (SF)	Econ Life	Energy Savings: Electric kWH/Year	Energy Savings: Fuel Oil kBTU/Yr	Energy Cost Saved: Electric $/Year	Energy Cost Saved: Fuel Oil $/Year	Energy Cost Saved: Total $/Year	Life Cycle Energy Cost Saved: Electric $LCC	Life Cycle Energy Cost Saved: Fuel Oil $LCC	Life Cycle Energy Cost Saved: Total $LCC	O&M Cost Saved: O&M Saved $/Year	O&M Cost Saved: O&M Saved $LCC	Invest-ment $	SIR	Payback Years
117-1	Baseline - Entire Building	9,181	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Totals - Building 117-1 Baseline		9,181	-	-	-	-	-	-	-	-	-	-	-	-	-	-
117-1	DDC Controls	9,181	10	19,374	319,706	$848	$1,959	$2,807	$7,273	$18,848	$26,121	$5,738	$48,945	$105,111	-	-
Totals - Bldg 117-1 DDC Controls Retrofit		9,181	10	19,374	319,706	$848	$1,959	$3,584	$7,273	$18,848	$32,786	$5,738	$48,945	$105,111	1.56	5.98
				7.6	kW Saved	$777	from kW savings		$6,665	from kW savings		Base on 3 HVAC Systems				
117-3	Baseline - Control Room	1,711	-	-	-	-	-	-	-	-	-	-	-	-	-	-
117-3	Baseline - Work Areas	9,302	-	-	-	-	-	-	-	-	-	-	-	-	-	-
117-3	Baseline - Mechanical Room	2,944	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Totals - Building 117-3 Baseline		13,957	-	-	-	-	-	-	-	-	-	-	-	-	-	-
117-3	DDC Controls - Control Room	1,711	10	1,789	2,046	$78	$13	$91	$672	$121	$792	$1,913	$16,315	-	-	-
117-3	DDC Controls - Work Areas	9,302	10	1,160	87,705	$51	$537	$588	$435	$5,171	$5,606	$1,913	$16,315	-	-	-
117-3	DDC Controls - Mechanical Room	2,944	10	0	191	$0	$1	$1	$0	$11	$11	$1,913	$16,315	-	-	-
Totals - Bldg 117-3 DDC Controls Retrofit		13,957	10	2,949	89,943	$129	$551	$1,457	$1,107	$5,303	$13,074	$5,738	$48,945	$92,261	1.50	6.23
				7.6	kW Saved	$777	from kW savings		$6,665	from kW savings						
117-3	Exhaust Ht. Recovery - Control Room	1,711	20	0	0	$0	$0	$0	$0	$0	$0	$0	$0	-	-	-
117-3	Exhaust Ht. Recovery - Work Areas	9,302	20	(504)	124,306	($22)	$762	$740	($332)	$14,146	$13,670	($677)	($10,078)	-	-	-
117-3	Exhaust Ht. Recovery - Mechanical Room	2,944	20	0	0	$0	$0	$0	$0	$0	$0	$0	$0	-	-	-
Totals - Bldg 117-3 Exhaust Ht. Rcovery Retrofit		13,957	20	(504)	124,306	($22)	$762	$730	($332)	$14,146	$13,670	($677)	($10,078)	$20,901	0.17	394.75
				(0.09)	kW Saved	($10)	from kW savings		($144)	from kW savings						
117-3	Air Curtains - Control Room	1,711	20	0	0	$0	$0	$0	$0	$0	$0	Analysis of Air Curtain Retrofit Halted				
117-3	Air Curtains - Work Areas	9,302	20	(15,190)	58,852	($665)	$361	($304)	($5,702)	$3,470	($2,233)	**for this building and similar (single**				
117-3	Air Curtains - Mechanical Room	2,944	20	0	0	$0	$0	$0	$0	$0	$0	**story buildings) because**				
Totals - Bldg 117-3 Air Curtain Retrofit		13,957	20	(15,190)	58,852	($665)	$361	($304)	($5,702)	$3,470	($2,233)	**no cost savings are achieved.**				
[Installed after DDC Control Retrofit only]																
117-3	Wall Insulation - Control Room	1,711	20	7	2,109	$0	$13	$13	$4	$240	$244	$0	$0	-	-	-
117-3	Wall Insulation - Work Areas	9,302	20	(1,160)	92,270	($51)	$565	$515	($765)	$10,501	$9,735	$0	$0	-	-	-
117-3	Wall Insulation - Mechanical Room	2,944	20	0	51	$0	$0	$0	$0	$6	$6	$0	$0	-	-	-
Totals - Bldg 117-3 Wall Insulation Retrofit		13,957	20	(1,154)	94,430	($50)	$579	$528	($761)	$10,746	$9,985	$0	$0	$25,081	0.40	2.33
117-5	Baseline - Work Room (Tower)	3,679	-	-	-	-	-	-	-	-	-	-	-	-	-	-
117-5	Baseline - Mechanical Room & WC's	2,760	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Totals - Building 117-5 Baseline		6,439	-	-	-	-	-	-	-	-	-	-	-	-	-	-
117-5	DDC Controls - Work Room (Tower)	3,679	10	25,141	1,286,064	$1,100	$7,881	$8,981	$9,438	$75,819	$85,257	$1,913	$16,315	-	-	-
117-5	DDC Controls - Mechanical Room & WC's	2,760	10	2,193	390,197	$96	$2,391	$2,487	$823	$23,004	$23,827	$1,913	$16,315	-	-	-
Totals - Bldg 117-5 DDC Controls Retrofit		6,439	10	27,334	1,676,261	$1,196	$10,273	$12,245	$10,261	$98,823	$115,749	$3,825	$32,630	$73,496	2.77	3.40
				7.6	kW Saved	$777	from kW savings		$6,665	from kW savings						
117-5	Air Curtains - Work Room (Tower)	3,679	20	(11,508)	504,317	($503)	$3,091	$2,587	($7,593)	$57,393	$49,800	($21)	($309)	-	-	-
117-5	Air Curtains - Mechanical Room & WC's	2,760	20	0	0	$0	$0	$0	$0	$0	$0	-	-	-	-	-
Totals - Bldg 117-5 Work Room Air Curtain Retrofit		6,439	20	(11,508)	504,317	($503)	$3,091	$2,284	($7,593)	$57,393	$45,227	($21)	($309)	$22,109	2.03	9.77
				(2.97)	kW Saved	($303)	from kW Savings		($4,573)	from kW Savings						
117-5	Exh Ht Recovery - Work Room (Tower)	3,679	20	2,808	783,392	$123	$4,801	$4,924	$1,853	$89,152	$91,005	($677)	($10,078)	-	-	-
117-5	Exh Ht Recovery - Mechanical Room & WC's	2,760	20	(1,045)	727,923	($46)	$4,461	$4,415	($689)	$82,840	$82,151	included	included	-	-	-
Totals - Bldg 117-5 Exhaust Heat Recovery Retrofit		6,439	20	1,763	1,511,315	$77	$9,262	$16,549	$1,164	$171,992	$305,349	($677)	($10,078)	$39,896	7.40	2.51

Table D-1.
Energy Conservation Opportunity Evaluations Based on Computerized HVAC Energy Use Simulations

Building Number	Building Area Description	Building (SF)	Econ Life	Energy Savings: Electric kWH/Year	Energy Savings: Fuel Oil kBTU/Yr	Energy Cost Saved: Electric $/Year	Energy Cost Saved: Fuel Oil $/Year	Energy Cost Saved: Total $/Year	Life Cycle Energy Cost Saved: Electric $LCC	Life Cycle Energy Cost Saved: Fuel Oil $LCC	Life Cycle Energy Cost Saved: Total $LCC	O&M Cost Saved: Total $LCC	O&M Cost Saved: Total $LCC	Invest-ment $	SIR	Payback Years
[Installed after DDC Control Retofit only]																
117-5	Wall Insulation - Work Room (Tower)	3,679	20	5,542	422,096	$242	$2,587	$2,829	$3,657	$48,036	$51,693	$0	$0	-	-	-
117-5	Wall Insulation - Mechanical Room & WC's	2,760	20	1	126,560	$0	$776	$776	$1	$14,403	$14,404	$0	$0	-	-	-
Totals - Bldg 117-5 Wall Insulation Retrofit		6,439	20	5,544	548,656	$243	$3,362	$3,605	$3,658	$62,439	$66,096	$0	$0	$67,749	0.98	18.79
Similar Buildings (Results of Building 117-3 & 117-5 specific area simulations are extended to similar buildings based on floor square footage)																
117-4AG	Baseline - Entire Above Ground Facility	4,810	-	-	-	-	-	-	-	-	-	-	-	-	-	-
117-4UG	Baseline - Offices, Toilets & Control Room	1,719	-	-	-	-	-	-	-	-	-	-	-	-	-	-
117-4UG	Baseline - Mechanical Room	2,204	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Totals - Building 117-4 Baseline		8,733	-	-	-	-	-	-	-	-	-	-	-	-	-	-
117-4AG	DDC Controls - Entire Above Ground Facility	4,810	10	600	45,352	$26	$278	$304	$225	$2,674	$2,899	$1,913	$16,315	-	-	-
117-4UG	DDC Controls - Offices, Toilets & Control Room	1,719	10	1,797	2,056	$79	$13	$91	$675	$121	$796	$1,913	$16,315	-	-	-
117-4UG	DDC Controls - Mechanical Room	2,204	10	0	0	$0	$0	$0	$0	$0	$0	$1,913	$16,315	-	-	-
Totals - Bldg 117-4 DDC Controls Retrofit		8,733	10	2,397	47,408	$105	$291	$1,172	$900	$2,795	$10,359	$5,738	$48,945	$89,030	1.42	6.54
				7.6	kW Saved	$777	from kW savings		$6,665	from kW savings						
117-6	Baseline - Office, Lab & Toilets	1,352	-	-	-	-	-	-	-	-	-	-	-	-	-	-
117-6	Baseline - Work Area (Towers)	5,208	-	-	-	-	-	-	-	-	-	-	-	-	-	-
117-6	Baseline - Mechanical Rooms	5,220	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Totals - Building 117-6 Baseline		11,780	-	-	-	-	-	-	-	-	-	-	-	-	-	-
117-6	DDC Controls - Office, Lab & Toilets	1,352	10	1,414	1,617	$62	$10	$72	$531	$95	$626	$1,913	$16,315	-	-	-
117-6	DDC Controls - Work Area (Towers)	5,208	10	35,590	1,820,555	$1,557	$11,157	$12,714	$13,361	$107,330	$120,691	$3,825	$32,630	-	-	-
117-6	DDC Controls - Mechanical Rooms	5,220	10	4,147	737,982	$181	$4,523	$4,704	$1,557	$43,507	$45,064	$3,825	$32,630	-	-	-
Totals - Building 117-6 DDC Controls Retrofit		11,780	10	41,151	2,560,153	$1,800	$15,689	$19,043	$15,448	$150,933	$179,710	$9,563	$81,576	$184,094	2.17	4.34
				15.2	kW Saved	$1,554	from kW savings		$13,329	from kW savings						
117-6	Tower Air Curtains - Office, Lab & Toilets	1,352	20	0	0	$0	$0	$0	$0	$0	$0	-	-	-	-	-
117-6	Tower Air Curtains - Work Area (Towers)	5,208	20	(16,290)	713,912	($713)	$4,375	$3,662	($10,748)	$81,245	$70,497	($21)	($309)	-	-	-
117-6	Tower Air Curtains - Mechanical Rooms	5,220	20	0	0	$0	$0	$0	$0	$0	$0	-	-	-	-	-
Totals - Bldg 117-6 Work Room Air Curtain Retrofit		11,780	20	(16,290)	713,912	($713)	$4,375	$3,460	($10,748)	$81,245	$67,449	($21)	($309)	$15,668	4.29	4.56
				(1.98)	kW Saved	($202)	from kW Savings		($3,049)	from kW Savings						
117-6	Exhaust Heat Recovery - Office, Lab & Toilets	1,352	20	0	0	$0	$0	$0	$0	$0	$0	-	-	-	-	-
117-6	Exhaust Heat Recovery - Work Area (Towers)	5,208	20	3,975	1,108,971	$174	$6,796	$6,970	$2,623	$126,204	$128,827	($677)	($10,078)	-	-	-
117-6	Exhaust Heat Recovery - Mechanical Rooms	5,220	20	(1,976)	1,376,724	($86)	$8,437	$8,351	($1,304)	$156,676	$155,372	($677)	($10,078)	-	-	-
Totals - Bldg 117-6 Exhaust Heat Recovery Retrofit		11,780	20	1,999	2,485,695	$87	$15,233	$15,302	$1,319	$282,880	$283,912	($1,355)	($20,156)	$73,565	3.59	5.27
				(0.19)	kW Saved	($19)	from kW savings		($287)	from kW savings						
117-8	Baseline - Work Areas	5,350	-	-	-	-	-	-	-	-	-	-	-	-	-	-
117-8	Baseline - Office, Control Room & Toilets	1,112	-	-	-	-	-	-	-	-	-	-	-	-	-	-
117-8	Baseline - Mechanical Room	1,672	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Totals - Building 117-8 Baseline		8,134	-	-	-	-	-	-	-	-	-	-	-	-	-	-
117-8	DDC Controls - Work Areas	5,350	10	667	50,443	$29	$309	$338	$250	$2,974	$3,224	$1,913	$16,315	-	-	-
117-8	DDC Controls - Office, Control Room & Toilets	1,112	10	1,163	1,330	$51	$8	$59	$436	$78	$515	$1,913	$16,315	-	-	-
117-8	DDC Controls - Mechanical Room	1,672	10	0	109	$0	$1	$1	$0	$6	$6	$1,913	$16,315	-	-	-
Totals - Building 117-8 DDC Controls Retrofit		8,134	10	1,830	51,882	$80	$318	$1,175	$687	$3,059	$10,410	$5,738	$48,945	$96,549	1.37	6.81
				7.6	kW Saved	$777	from kW savings		$6,665	from kW savings						

Table D-1.
Energy Conservation Opportunity Evaluations Based on Computerized HVAC Energy Use Simulations

Similar Buildings (Results of Building 117-3 & 117-5 specific area simulations are extended to similar buildings based on floor square footage)

Building Number	Building Area Description	Building (SF)	Econ Life	Energy Savings: Electric kWH/Year	Energy Savings: Fuel Oil kBTU/Yr	Energy Cost Saved: Electric $/Year	Energy Cost Saved: Fuel Oil $/Year	Energy Cost Saved: Total $/Year	Life Cycle Energy Cost Saved: Electric $LCC	Life Cycle Energy Cost Saved: Fuel Oil $LCC	Life Cycle Energy Cost Saved: Total $LCC	O&M Cost Saved: O&M Saved $/Year	O&M Cost Saved: O&M Saved $LCC	Invest-ment $	SIR	Payback Years
117-10	Baseline - Work Areas	3,339	-	-	-	-	-	-	-	-	-	-	-	-	-	-
117-10	Baseline - Office, Control Room & Toilets	1,444	-	-	-	-	-	-	-	-	-	-	-	-	-	-
117-10	Baseline - Mechanical Room	4,193	-	-	-	-	-	-	-	-	-	-	-	-	-	-
117-11	Baseline - Entire Building	2,471	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Totals - Buildings 117-10 & 117-11 Baseline		11,447	-	-	-	-	-	-	-	-	-	-	-	-	-	-
117-10	DDC Controls - Work Areas	3,339	10	416	31,482	$18	$193	$211	$156	$1,856	$2,012	$1,913	$16,315	-	-	-
117-10	DDC Controls - Office, Control Room & Toilets	1,444	10	1,510	1,727	$66	$11	$77	$567	$102	$669	$1,913	$16,315	-	-	-
117-10	DDC Controls - Mechanical Room	4,193	10	1	272	$0	$2	$2	$0	$16	$16	$1,913	$16,315	-	-	-
117-11	DDC Controls - Entire Building	2,471	10	308	23,298	$13	$143	$156	$116	$1,374	$1,489	$1,913	$16,315	-	-	-
Totals - Buildings 117-10 & 117-11 DDC Controls		8,976	10	1,927	33,481	$84	$205	$1,066	$723	$1,974	$9,362	$5,738	$48,945	$98,744	1.34	6.94
				7.6	kW Saved	$777	from kW savings		$6,665	from kW savings						

Adjustment for Reno vs. Hawthorne, Nevada Energy Use:

Location	Heating DD/Year	Cooling DD/Year
Simulations @ Reno Nevada	6,022	329
Actual Site Hawthorne (WADF)	5,508	487
Adjustment Factors:	0.915	1.480

Energy Costs and Adjustment Factors		
Electric Usage Cost & Taxes, **including demand charges:**		
$0.0438 per kWH	8.58 = 10 Yr UPV	15.08 = 20 Yr UPV
Distillate Fuel Oil Cost, including Taxes:		
$6.1283 per Mil BTU's	9.62 = 10 Yr UPV	18.57 = 20 Yr UPV
Non-Energy Cash Flows		
	8.53 = 10 Yr UPV	14.88 = 20 Yr UPV

Table D-2.
Energy Costs and Life Cycle Cost Analysis Factors

Electricity Costs

Electric Power Costs (Sierra Pacific Power Corporation Rate E93):

Energy	($/kWH)	$0.0438
Demand	($/kW-Month)	$8.517

No. 2 Fuel Oil (Distillate) Cost

Cost per Gallon:	$0.850	=	$6.128	per Million BTUs

Life Cycle Cost Analysis Discount Factors

NISTIR 85-3273-9 Used for Discount Factors: October 1994, Census Region 4, Industrial

Electricity UPV	10 year =	8.58	15 Year =	12.02	20 Year =	15.08
Distillate Fuels UPV	10 year =	9.62	15 Year =	14.23	20 Year =	18.57
Non-Energy UPV	10 year =	8.53	15 Year =	11.94	20 Year =	14.88

SPW year	1	0.971
	2	0.943
	3	0.915
	4	0.888
	5	0.863
	6	0.837
	7	0.813
	8	0.789
	9	0.766
	10	0.744
	11	0.722
	12	0.701
	13	0.681
	14	0.661
	15	0.642

Table D-2.
Energy Costs and Life Cycle Cost Analysis Factors

Development of Electricity Costs for Analyses

Base Prices per Sierra Pacific Power Company Rate Schedule R-1

	Base		Adjustment	Revised Prices
Customer Charge	$1,247	per Month	none	
Demand Charge	$8.74	per kW per Month	($0.2229)	$8.51713
Energy Charge	$0.04484	per kWH	($0.0011)	$0.04375

Adjustments to these prices are made as follows:

Fuel Adjustment

Month	**Fuel Adjustment projected for 1995 ($ per kWH)**
January	0.00220
February	(0.00121)
March	(0.00118)
April	0.00022
May	0.00031
June	(0.00050)
July	(0.00027)
August	0.00217
September	(0.00140)
October	0.00033
November	(0.00018)
December	0.00019
Average	**0.00006**

Power Factor Adjustment

Power factor adjustment is applied to both the energy and demand charges:

0.15% cost adjustment per % above or below power factor of 80%.
Hawthorne has capacitor banks to correct the power factor. The power factor is maintained at about 97%, continuously. Thus, the price reduction is:

(97% - 80%) x 0.15% = 2.550% reduction in demand and usage charges.

Table D-3.
DDC Controls Retrofit Input-Output Summary

BUILDING DDC CONTROLS RETROFIT	HARDWARE REQUIREMENTS																																					
	OUTPUT FROM DDC CONTROLS									INPUT TO DDC CONTROLS																				ALARMS								
	DIGITAL						ANALOG			DIGITAL								ANALOG												DIGITAL			ANALOG						
BUILDING NUMBER & POINT DESCRIPTION	CONTROL RELAY	SOLENOID	OFF / AUTO	P/E RELAY	SELECTOR RELAY		CONTROL PT. ADJUSTMENT			HIGH / LOW	PULSE	DIFFERENTIAL PRESS SW	PRESSURE SWITCH	AUXILLARY CONTACT	FLOW SWITCH	GENERAL ALARM		SPACE TEMPERATURE	SUPPLY AIR TEMPERATURE	RETURN AIR TEMPERATURE	PRESSURE, PSIA, PSIG	POSITION SENSOR	STEAM PRESSURE	FLOW	GLYCOL TEMPERATURE	OUTSIDE AIR TEMPERATUR	FLUID TEMPERATURE		CONTACT CLOSURE			HIGH LIMIT	LOW LIMIT	RUN TIME			
Building 117-1 Services & Supply																																						
117-1 AHU - 6 ZONES	3			13										2	1			6	7	1	1	12				1						1	2					
117-1 ELECTRIC COIL	1													1				1	2													1						
UNIT HEATERS	2													2				1																				
GLYCOL HE STEAM CNTRL				2										2								2			2	1												
GLYCOL CIRC PUMPS	2													2				2						2														
STEAM PRV STATIONS				2										2								2	4															
GLYCOL MAKE-UP PUMP												1		1										1									1						
STM COND RCVR - PUMPS																								1			1					1						
Subtotal Building 117-1	8	0	0	17	0	0	0	0	0	0	0	1	0	12	1	0	0	10	9	1	1	16	4	4	2	2	0	1	0	0	0	3	3	0	0	0	0	
Building 117-3 Decontamination of Small Parts																																						
CONTROL RM AC UNIT	2		1	4										2	1			1	1	1	1	4				1						1	2					
WORK ROOM AC UNIT	1			2										1	1			1	1		1	2				1						1	2					
MECH RM HV UNIT				1														1	1		1	1				1						1	1					
CONVECTOR CONTROL	1													1				1																				
UNIT HEATERS	2													2				1																				
GLYCOL HE STEAM CNTRL				2										2								2			2	1												
GLYCOL CIRC PUMPS	2													2				2						2														
STEAM PRV STATIONS				2										2								2	4															
GLYCOL MAKE-UP PUMP												1		1										1									1						
STM COND RCVR - PUMPS																								1			1					1						
Subtotal Building 117-3	8	0	1	11	0	0	0	0	0	0	0	1	0	13	2	0	0	7	3	1	3	11	4	4	2	4	0	1	0	0	0	4	6	0	0	0	0	

Table D-3.
DDC Controls Retrofit Input-Output Summary

BUILDING DDC CONTROLS RETROFIT	HARDWARE REQUIREMENTS																																				
	OUTPUT FROM DDC CONTROLS									INPUT TO DDC CONTROLS																				ALARMS								
	DIGITAL						ANALOG			DIGITAL								ANALOG												DIGITAL			ANALOG					
BUILDING NUMBER & POINT DESCRIPTION	CONTROL RELAY	SOLENOID	OFF / AUTO	P/E RELAY	SELECTOR RELAY		CONTROL PT. ADJUSTMENT			HIGH / LOW	PULSE	DIFFERENTIAL PRESS SW	PRESSURE SWITCH	AUXILLARY CONTACT	FLOW SWITCH	GENERAL ALARM		SPACE TEMPERATURE	SUPPLY AIR TEMPERATURE	RETURN AIR TEMPERATURE	PRESSURE, PSIA, PSIG	POSITION SENSOR	STEAM PRESSURE	FLOW	GLYCOL TEMPERATURE	OUTSIDE AIR TEMPERATURE	FLUID TEMPERATURE		CONTACT CLOSURE			HIGH LIMIT	LOW LIMIT	RUN TIME			
Building 117-4 Bulk Explosives Disposal																																					
CONTROL RM AC UNIT	2		1	4										2	1			1	1	1	1	4				1						1	2				
WORK ROOM AC UNIT	1			2	1									1	1			1	1		1	2				1						1	2				
MECH RM HV UNIT				1														1	1		1	1				1						1	1				
CONVECTOR CONTROL	1													1				1																			
GLYCOL HE STEAM CNTRL				2										2								2			2	1											
GLYCOL CIRC PUMPS	2													2				2						2													
STEAM PRV STATIONS				2										2								2	4														
GLYCOL MAKE-UP PUMP												1		1										1									1				
STM COND RCVR - PUMPS																								1			1										
Subtotal Building 117-4	6	0	1	11	1	0	0	0	0	0	0	1	0	11	2	0	0	6	3	1	3	11	4	4	2	4	0	1	0	0	0	4	6	0	0	0	0
Building 117-5 Refining Building																																					
WORK ROOM AC UNIT	1			2										1	1			1	1		1	2				1						1	2				
MECH RM HV UNIT				1														1	1		1	1				1						1	1				
CONVECTOR CONTROL	1													1				1																			
HEATING COIL CNTRL	1													1				1																			
UNIT HEATERS	2													2				1																			
GLYCOL HE STEAM CNTRL				2										2								2			2	1											
GLYCOL CIRC PUMPS	2													2				2						2													
STEAM PRV STATIONS				2										2								2	4														
GLYCOL MAKE-UP PUMP												1		1										1									1				
STM COND RCVR - PUMPS																								1			1										
Subtotal Building 117-5	7	0	0	7	0	0	0	0	0	0	0	1	0	12	1	0	0	7	2	0	2	7	4	4	2	3	0	1	0	0	0	3	4	0	0	0	0

Table D-3.
DDC Controls Retrofit Input-Output Summary

BUILDING DDC CONTROLS RETROFIT	HARDWARE REQUIREMENTS																																				
	OUTPUT FROM DDC CONTROLS									INPUT TO DDC CONTROLS																					ALARMS							
	DIGITAL						ANALOG			DIGITAL								ANALOG												DIGITAL			ANALOG					
BUILDING NUMBER & POINT DESCRIPTION	CONTROL RELAY	SOLENOID	OFF / AUTO	P/E RELAY	SELECTOR RELAY		CONTROL PT. ADJUSTMENT			HIGH / LOW	PULSE	DIFFERENTIAL PRESS SW	PRESSURE SWITCH	AUXILLARY CONTACT	FLOW SWITCH	GENERAL ALARM		SPACE TEMPERATURE	SUPPLY AIR TEMPERATURE	RETURN AIR TEMPERATURE	PRESSURE, PSIA, PSIG	POSITION SENSOR	STEAM PRESSURE	FLOW	GLYCOL TEMPERATURE	OUTSIDE AIR TEMPERATURE	FLUID TEMPERATURE			CONTACT CLOSURE			HIGH LIMIT	LOW LIMIT	RUN TIME			
Building 117-6 Steamout Building																																					
N. LAB & WC AC UNIT	2		1	4										2	1			1	1	1	1	4				1						1	2				
N. WORK TOWER AC UNIT	1			2										1	1			1	1		1	2				1						1	2				
N. MECH RM HV UNIT				1														1	1		1	1				1						1	1				
N. CONVECTOR CNTRL	1													1				1																			
N. MECH RM UNIT HTR	1													1				1																			
S. CNTRL RM AC UNIT	2		1	4										2	1			1	1	1	1	4				1						1	2				
S. WORK TOWER AC UNIT	1			2										1	1			1	1		1	2				1						1	2				
S. MECH RM HV UNIT				1														1	1		1	1				1						1	1				
S. CONVECTOR CNTRL	1													1				1																			
S. CONVECTOR CNTRL	1													1				1																			
S. MECH RM UNIT HTR	1													1				1																			
GLYCOL HE STEAM CNTRL				4										4								4			4	2											
GLYCOL CIRC PUMPS	4													4				4						4													
STEAM PRV STATIONS				4										4								4	8														
GLYCOL MAKE-UP PUMP												2		2										2									2				
STM COND RCVR - PUMPS																								2			2					2				
Subtotal Building 117-6	15	0	2	22	0	0	0	0	0	0	0	2	0	25	4	0	0	15	6	2	6	22	8	8	4	8	0	2	0	0	0	8	12	0	0	0	0

Table D-3.
DDC Controls Retrofit Input-Output Summary

BUILDING DDC CONTROLS RETROFIT	HARDWARE REQUIREMENTS																																				
	OUTPUT FROM DDC CONTROLS									INPUT TO DDC CONTROLS																				ALARMS							
	DIGITAL						ANALOG			DIGITAL								ANALOG												DIGITAL			ANALOG					
BUILDING NUMBER & POINT DESCRIPTION	CONTROL RELAY	SOLENOID	OFF / AUTO	P/E RELAY	SELECTOR RELAY		CONTROL PT. ADJUSTMENT			HIGH / LOW	PULSE	DIFFERENTIAL PRESS SW	PRESSURE SWITCH	AUXILLARY CONTACT	FLOW SWITCH	GENERAL ALARM		SPACE TEMPERATURE	SUPPLY AIR TEMPERATURE	RETURN AIR TEMPERATURE	PRESSURE, PSIA, PSIG	POSITION SENSOR	STEAM PRESSURE	FLOW	GLYCOL TEMPERATURE	OUTSIDE AIR TEMPERATUR	FLUID TEMPERATURE		CONTACT CLOSURE			HIGH LIMIT	LOW LIMIT	RUN TIME			
Building 117-8 Mechanical Removal Building																																					
CONTROL RM AC UNIT	2		1	4										2	1			1	1	1	1	4				1						1	2				
WORK ROOM AC UNIT	1			2										1	1			1	1		1	2				1						1	2				
MECH RM HV UNIT				1														1	1		1	1				1						1	1				
CONVECTOR CONTROL	1													1				1																			
HEATING COIL CNTRL	1													1				1																			
UNIT HEATERS	2													2				1																			
DOOR HEATERS	1													1				1																			
GLYCOL HE STEAM CNTRL				2										2								2			2	1											
GLYCOL CIRC PUMPS	2													2				2						2													
STEAM PRV STATIONS				2										2								2	4														
GLYCOL MAKE-UP PUMP												1		1										1									1				
STM COND RCVR - PUMPS																								1			1					1				
Subtotal Building 117-8	10	0	1	11	0	0	0	0	0	0	0	1	0	15	2	0	0	9	3	1	3	11	4	4	2	4	0	1	0	0	0	4	6	0	0	0	0

Table D-3.
DDC Controls Retrofit Input-Output Summary

BUILDING DDC CONTROLS RETROFIT	HARDWARE REQUIREMENTS																																				
	OUTPUT FROM DDC CONTROLS									INPUT TO DDC CONTROLS																				ALARMS							
	DIGITAL						ANALOG			DIGITAL								ANALOG											DIGITAL			ANALOG					
BUILDING NUMBER & POINT DESCRIPTION	CONTROL RELAY	SOLENOID	OFF / AUTO	P/E RELAY	SELECTOR RELAY		CONTROL PT. ADJUSTMENT			HIGH / LOW	PULSE	DIFFERENTIAL PRESS SW	PRESSURE SWITCH	AUXILLARY CONTACT	FLOW SWITCH	GENERAL ALARM		SPACE TEMPERATURE	SUPPLY AIR TEMPERATURE	RETURN AIR TEMPERATURE	PRESSURE, PSIA, PSIG	POSITION SENSOR	STEAM PRESSURE	FLOW	GLYCOL TEMPERATURE	OUTSIDE AIR TEMPERATURE	FLUID TEMPERATURE		CONTACT CLOSURE			HIGH LIMIT	LOW LIMIT	RUN TIME			
Buildings 117-10 & 117-11 Preparation Building and Accumulator Building																																					
CONTROL RM AC UNIT	2		1	4										2	1			1	1	1	1	4				1						1	2				
WORK ROOM AC UNIT	1			2										1	1			1	1		1	2				1						1	2				
MECH RM HV UNIT				1														1	1		1	1				1						1	1				
CONVECTOR CONTROL	1													1				1																			
HEATING COIL CNTRL	1													1				1																			
UNIT HEATERS	2													2				1																			
DOOR HEATERS	2													2				2																			
GLYCOL HE STEAM CNTRL				2										2								2			2	1											
GLYCOL CIRC PUMPS	2													2				2						2													
STEAM PRV STATIONS				2										2								2	4														
GLYCOL MAKE-UP PUMP												1		1										1									1				
STM COND RCVR - PUMPS																								1			1					1				
Subtotal Bldgs 117-10&11	11	0	1	11	0	0	0	0	0	0	0	1	0	16	2	0	0	10	3	1	3	11	4	4	2	4	0	1	0	0	0	4	6	0	0	0	0
TOTAL DDC CONTROLS	65	0	6	90	1	0	0	0	0	0	0	8	0	##	14	0	0	64	29	7	21	89	32	32	16	29	0	8	0	0	0	30	43	0	0	0	0

CONSTRUCTION COST ESTIMATE					Date Prepared November-94		Sheet 1 of 7
Project ECIP Facility Energy Improvements				Project No.	Basis for Estimate		
Location Western Area Demilitarization Facility (WADF) Hawthorne Army Ammunition Plant, Nevada					Code A (no design competed)		
Engineer-Architect Keller & Gannon							
Drawing No. HVAC - DDC Controls Retrofit		Estimator B. I. Horst			Checked By R. C. Lennig		

Line Item	Quantity No. Units	Quantity Unit Meas.	Labor Per Unit	Labor Total	Material Per Unit	Material Total	Total Cost
Building 117-1 Services & Support Building - HVAC System Repairs							
Damper Actuators - Pneumatic	9	EA	$50	$450	$62	$558	$1,008
Repair all HVAC System Dampers	9	EA	$144	$1,296	$132	$1,189	$2,485
Duct Repairs and Duct Cleaning	1	Job	$1,000	$1,000	$250	$250	$1,250
Balance Air Distribution System	1	Job	Included		$954	$954	$954
Subtotal Bldg 117-1 HVAC Repair				**$2,746**		**$2,951**	**$5,697**
Building 117-1 Services & Support Building - DDC Controls Retrofit							
Control Relay	8	EA	$50	$400	$300	$2,400	$2,800
P/E Relay	17	EA	$55	$943	$130	$2,210	$3,153
Differential Pressure Switch	1	EA	$50	$50	$730	$730	$780
Auxilliary Contact	12	EA	$50	$600	$350	$4,200	$4,550
Flow Switch	1	EA	$50	$50	$470	$470	$940
Space Temperature (Thermostat)	10	EA	$83	$832	$527	$5,268	$6,100
Supply Air Temperature	9	EA	$67	$599	$273	$2,461	$3,060
Return Air Temperature	1	EA	$67	$67	$273	$273	$340
Pressure Sensor	1	EA	$83	$83	$485	$485	$568
Position Sensor	16	EA	$67	$1,064	$300	$4,800	$5,864
Steam Pressure	4	EA	$67	$268	$873	$3,492	$3,760
Flow	4	EA	$83	$333	$2,117	$8,467	$8,800
Glycol Temperature	2	EA	$67	$133	$533	$1,067	$1,200
Outside Air Temperature	2	EA	$67	$133	$273	$547	$680
High Limit	3	EA	$50	$150	$270	$810	$960
Low Limit	3	EA	$50	$150	$270	$810	$960
DDC Control Unit - 32 Point	3	EA	$750	$2,250	$4,250	$12,750	$15,000
Subtotal Bldg 117-1 DDC Cntrls	94	Sensors/Cntrls		**$8,104**		**$51,242**	**$59,516**
Building 117-1 HVAC Repairs & DDC Controls				**$10,850**		**$54,193**	**$65,213**
Nevada Sales Tax	3.75%	%		-		$2,032	$2,032
Subtotal							$67,245
Contractor OH & Profit	25.0%	%					$16,811
Subtotal							$84,057
Bond	1.5%	%					$1,261
Subtotal							$85,318
Estimating Contingency	10.0%	%					$8,532
Total Probable Construction Cost: DDC Controls & HVAC Repairs							**$93,849**

Avoided Cost of Repairs & Replacements	**$10,850**		**$46,507**	**$82,483**

CONSTRUCTION COST ESTIMATE					Date Prepared November-94		Sheet 2 of 7
Project ECIP Facility Energy Improvements				Project No.	Basis for Estimate		
Location Western Area Demilitarization Facility (WADF) Hawthorne Army Ammunition Plant, Nevada					Code A (no design competed)		
Engineer-Architect Keller & Gannon							
Drawing No. HVAC - DDC Controls Retrofit		Estimator B. I. Horst			Checked By R. C. Lennig		

Line Item	Quantity No. Units	Quantity Unit Meas.	Labor Per Unit	Labor Total	Material Per Unit	Material Total	Total Cost
Building 117-3 Decontamination of Small Items Building - HVAC Repairs							
Repair all HVAC System Dampers	4	EA	$144	$576	$132	$528	$1,104
Duct Repairs and Duct Cleaning	1	Job	$1,000	$1,000	$250	$250	$1,250
Balance Air Distribution System	1	Job	Included		$954	$954	$954
Subtotal Bldg 117-3 HVAC Repair				**$1,576**		**$1,732**	**$3,308**
Building 117-3 Decontamination of Small Items Building - DDC Controls Retrofit							
Control Relay	8	EA	$50	$400	$300	$2,400	$2,800
On/Off Relay	1	EA	$50	$50	$500	$500	$550
P/E Relay	11	EA	$55	$610	$130	$1,430	$2,040
Differential Pressure Switch	1	EA	$50	$50	$730	$730	$780
Auxilliary Contact	13	EA	$50	$650	$350	$4,550	$5,200
Flow Switch	2	EA	$50	$100	$470	$940	$1,040
Space Temperature (Thermostat)	7	EA	$83	$582	$527	$3,688	$4,270
Supply Air Temperature	3	EA	$67	$200	$273	$820	$1,020
Return Air Temperature	1	EA	$67	$67	$273	$273	$340
Pressure Sensor	3	EA	$83	$249	$485	$1,455	$1,704
Position Sensor	11	EA	$67	$732	$300	$3,300	$4,032
Steam Pressure	4	EA	$67	$268	$873	$3,492	$3,760
Flow	4	EA	$83	$333	$2,117	$8,467	$8,800
Glycol Temperature	2	EA	$67	$133	$533	$1,067	$1,200
Outside Air Temperature	4	EA	$67	$266	$273	$1,094	$1,360
High Limit	4	EA	$50	$200	$270	$1,080	$1,280
Low Limit	6	EA	$50	$300	$270	$1,621	$1,921
DDC Control Unit - 32 Point	3	EA	$750	$2,250	$4,250	$12,750	$15,000
Subtotal Bldg 117-3 DDC Cntrls	85	Sensors/Cntrls		**$7,439**		**$49,658**	**$57,097**
Building 117-3 HVAC Repairs & DDC Controls				**$9,015**		**$51,391**	**$60,406**
Nevada Sales Tax	3.75%	%		-		$1,927	$1,927
Subtotal							$59,025
Contractor OH & Profit	25.0%	%					$14,756
Subtotal							$73,781
Bond	1.5%	%					$1,107
Subtotal							$74,887
Estimating Contingency	10.0%	%					$7,489
Total Probable Construction Cost							**$82,376**

Avoided Cost of Repairs & Replacements	**$9,015**	**$43,942**	**$76,208**

CONSTRUCTION COST ESTIMATE					Date Prepared November-94		Sheet 3 of 7
Project ECIP Facility Energy Improvements				Project No.	Basis for Estimate		
Location Western Area Demilitarization Facility (WADF) Hawthorne Army Ammunition Plant, Nevada					Code A (no design competed)		
Engineer-Architect Keller & Gannon							
Drawing No. HVAC - DDC Controls Retrofit		Estimator B. I. Horst			Checked By R. C. Lennig		
Line Item	Quantity No. Units	Quantity Unit Meas.	Labor Per Unit	Labor Total	Material Per Unit	Material Total	Total Cost
Building 117-4 Bulk Explosives Disposal Building - DDC Control Retrofit							
Control Relay	6	EA	$50	$300	$300	$1,800	$2,100
On/Off Relay	1	EA	$50	$50	$500	$500	$550
P/E Relay	11	EA	$55	$610	$130	$1,430	$2,040
Selector Relay	1	EA	$111	$111	$64	$64	$174
Differential Pressure Switch	1	EA	$50	$50	$730	$730	$780
Auxilliary Contact	11	EA	$50	$550	$350	$3,850	$4,400
Flow Switch	2	EA	$50	$100	$470	$940	$1,040
Space Temperature (Thermostat)	6	EA	$83	$499	$527	$3,161	$3,660
Supply Air Temperature	3	EA	$67	$200	$273	$820	$1,020
Return Air Temperature	1	EA	$67	$67	$273	$273	$340
Pressure Sensor	3	EA	$83	$249	$485	$1,455	$1,704
Position Sensor	11	EA	$67	$732	$300	$3,300	$4,032
Steam Pressure	4	EA	$67	$268	$873	$3,492	$3,760
Flow	4	EA	$83	$333	$2,117	$8,467	$8,800
Glycol Temperature	2	EA	$67	$133	$533	$1,067	$1,200
Outside Air Temperature	4	EA	$67	$266	$273	$1,094	$1,360
High Limit	4	EA	$50	$200	$270	$1,080	$1,280
Low Limit	6	EA	$50	$300	$270	$1,621	$1,921
DDC Control Unit - 32 Point	3	EA	$750	$2,250	$4,250	$12,750	$15,000
Subtotal Building 117-4	81	Sensors/Cntrls		**$7,267**		**$47,895**	**$55,162**
Nevada Sales Tax	3.75%	%		-		$1,796	$1,796
Subtotal							$56,958
Contractor OH & Profit	25.0%	%					$14,239
Subtotal							$71,197
Bond	1.5%	%					$1,068
Subtotal							$72,265
Estimating Contingency	10.0%	%					$7,226
Total Probable Construction Cost							**$79,491**

Avoided Cost of Pneumatic Controls Repair	**$7,267**	**$40,711**	**$66,958**

CONSTRUCTION COST ESTIMATE	Date Prepared November-94	Sheet 4 of 7
Project: ECIP Facility Energy Improvements	Project No.	Basis for Estimate: Code A (no design competed)
Location: Western Area Demilitarization Facility (WADF), Hawthorne Army Ammunition Plant, Nevada		
Engineer-Architect: Keller & Gannon		
Drawing No.: HVAC - DDC Controls Retrofit	Estimator: B. I. Horst	Checked By: R. C. Lennig

Line Item	Quantity No. Units	Quantity Unit Meas.	Labor Per Unit	Labor Total	Material Per Unit	Material Total	Total Cost
Building 117-5 Refining Building - DDC Controls Retrofit							
Control Relay	7	EA	$50	$350	$300	$2,100	$2,450
P/E Relay	7	EA	$55	$388	$130	$910	$1,298
Differential Pressure Switch	1	EA	$50	$50	$730	$730	$780
Auxilliary Contact	12	EA	$50	$600	$350	$4,200	$4,800
Flow Switch	1	EA	$50	$50	$470	$470	$520
Space Temperature (Thermostat)	7	EA	$83	$582	$527	$3,688	$4,270
Supply Air Temperature	2	EA	$67	$133	$273	$547	$680
Pressure Sensor	2	EA	$83	$166	$485	$970	$1,136
Position Sensor	7	EA	$67	$466	$300	$2,100	$2,566
Steam Pressure	4	EA	$67	$268	$873	$3,492	$3,760
Flow	4	EA	$83	$333	$2,117	$8,467	$8,800
Glycol Temperature	2	EA	$67	$133	$533	$1,067	$1,200
Outside Air Temperature	3	EA	$67	$200	$273	$820	$1,020
High Limit	3	EA	$50	$150	$270	$810	$960
Low Limit	4	EA	$50	$200	$270	$1,080	$1,280
DDC Control Unit - 32 Point	2	EA	$750	$1,500	$4,250	$8,500	$10,000
Subtotal Building 117-5	66	Sensors/Cntrls		**$5,569**		**$39,952**	**$45,521**
Nevada Sales Tax	3.75%	%		-		$1,498	$1,498
Subtotal							$47,019
Contractor OH & Profit	25.0%	%					$11,755
Subtotal							$58,774
Bond	1.5%	%					$882
Subtotal							$59,656
Estimating Contingency	10.0%	%					$5,966
Total Probable Construction Cost							**$65,621**

Avoided Cost of Pneumatic Controls Repair	**$5,569**	**$33,960**	**$55,166**

CONSTRUCTION COST ESTIMATE					Date Prepared November-94		Sheet 5 of 7
Project ECIP Facility Energy Improvements				Project No.	Basis for Estimate		
Location Western Area Demilitarization Facility (WADF) Hawthorne Army Ammunition Plant, Nevada					Code A (no design competed)		
Engineer-Architect Keller & Gannon							
Drawing No. HVAC - DDC Controls Retrofit			Estimator B. I. Horst		Checked By R. C. Lennig		
Line Item	Quantity		Labor		Material		Total
	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	Cost
Building 117-6 Steamout Building - DDC Controls Retrofit							
Control Relay	15	EA	$50	$750	$300	$4,500	$5,250
On/Off Relay	2	EA	$50	$100	$500	$1,000	$1,100
P/E Relay	22	EA	$55	$1,220	$130	$2,860	$4,080
Differential Pressure Switch	2	EA	$50	$100	$730	$1,460	$1,560
Auxilliary Contact	25	EA	$50	$1,250	$350	$8,750	$10,000
Flow Switch	4	EA	$50	$200	$470	$1,880	$2,080
Space Temperature (Thermostat)	15	EA	$83	$1,247	$527	$7,903	$9,150
Supply Air Temperature	6	EA	$67	$399	$273	$1,641	$2,040
Return Air Temperature	2	EA	$67	$133	$273	$547	$680
Pressure Sensor	6	EA	$83	$499	$485	$2,910	$3,409
Position Sensor	22	EA	$67	$1,464	$300	$6,600	$8,064
Steam Pressure	8	EA	$67	$536	$873	$6,984	$7,520
Flow	8	EA	$83	$665	$2,117	$16,935	$17,600
Glycol Temperature	4	EA	$67	$266	$533	$2,134	$2,400
Outside Air Temperature	8	EA	$67	$532	$273	$2,188	$2,720
High Limit	8	EA	$50	$400	$270	$2,161	$2,561
Low Limit	12	EA	$50	$600	$270	$3,241	$3,841
DDC Control Unit - 32 Point	6	EA	$750	$4,500	$4,250	$25,500	$30,000
Subtotal Building 117-6	169	Sensors/Cntrls		**$14,862**		**$99,193**	**$114,055**
Nevada Sales Tax	3.75%	%		-		$3,720	$3,720
Subtotal							$117,775
Contractor OH & Profit	25.0%	%					$29,444
Subtotal							$147,218
Bond	1.5%	%					$2,208
Subtotal							$149,427
Estimating Contingency	10.0%	%					$14,943
Total Probable Construction Cost							**$164,369**

Avoided Cost of Pneumatic Controls Repair	**$14,862**	**$84,314**	**$138,412**

CONSTRUCTION COST ESTIMATE	Date Prepared November-94	Sheet 6 of 7
Project: ECIP Facility Energy Improvements	Project No.	Basis for Estimate
Location: Western Area Demilitarization Facility (WADF) Hawthorne Army Ammunition Plant, Nevada		Code A (no design competed)
Engineer-Architect: Keller & Gannon		
Drawing No.: HVAC - DDC Controls Retrofit	Estimator: B. I. Horst	Checked By: R. C. Lennig

Line Item	Quantity No. Units	Quantity Unit Meas.	Labor Per Unit	Labor Total	Material Per Unit	Material Total	Total Cost
Building 117-8 Mechanical Removal Building							
Control Relay	10	EA	$50	$500	$300	$3,000	$3,500
On/Off Relay	1	EA	$50	$50	$500	$500	$550
P/E Relay	11	EA	$55	$610	$130	$1,430	$2,040
Differential Pressure Switch	1	EA	$50	$50	$730	$730	$780
Auxilliary Contact	15	EA	$50	$750	$350	$5,250	$6,000
Flow Switch	2	EA	$50	$100	$470	$940	$1,040
Space Temperature (Thermostat)	9	EA	$83	$748	$527	$4,742	$5,490
Supply Air Temperature	3	EA	$67	$200	$273	$820	$1,020
Return Air Temperature	1	EA	$67	$67	$273	$273	$340
Pressure Sensor	3	EA	$83	$249	$485	$1,455	$1,704
Position Sensor	11	EA	$67	$732	$300	$3,300	$4,032
Steam Pressure	4	EA	$67	$268	$873	$3,492	$3,760
Flow	4	EA	$83	$333	$2,117	$8,467	$8,800
Glycol Temperature	2	EA	$67	$133	$533	$1,067	$1,200
Outside Air Temperature	4	EA	$67	$266	$273	$1,094	$1,360
High Limit	4	EA	$50	$200	$270	$1,080	$1,280
Low Limit	6	EA	$50	$300	$270	$1,621	$1,921
DDC Control Unit - 32 Point	3	EA	$750	$2,250	$4,250	$12,750	$15,000
Subtotal Building 117-8	91	Sensors/Cntrls		**$7,806**		**$52,012**	**$59,817**
Nevada Sales Tax	3.75%	%		-		$1,950	$1,950
Subtotal							$61,768
Contractor OH & Profit	25.0%	%					$15,442
Subtotal							$77,210
Bond	1.5%	%					$1,158
Subtotal							$78,368
Estimating Contingency	10.0%	%					$7,837
Total Probable Construction Cost							**$86,205**

Avoided Cost of Pneumatic Controls Repair	**$7,806**	**$44,210**	**$72,594**

CONSTRUCTION COST ESTIMATE					Date Prepared November-94		Sheet 7 of 7
Project ECIP Facility Energy Improvements				Project No.	Basis for Estimate		
Location Western Area Demilitarization Facility (WADF) Hawthorne Army Ammunition Plant, Nevada					Code A (no design competed)		
Engineer-Architect Keller & Gannon							
Drawing No. HVAC - DDC Controls Retrofit		Estimator B. I. Horst			Checked By R. C. Lennig		
Line Item	Quantity No. Units	Quantity Unit Meas.	Labor Per Unit	Labor Total	Material Per Unit	Material Total	Total Cost
Building 117-10 Preparation Building & Building 117-11 Accumulator Building							
Control Relay	11	EA	$50	$550	$300	$3,300	$3,850
On/Off Relay	1	EA	$50	$50	$500	$500	$550
P/E Relay	11	EA	$55	$610	$130	$1,430	$2,040
Differential Pressure Switch	1	EA	$50	$50	$730	$730	$780
Auxilliary Contact	16	EA	$50	$800	$350	$5,600	$6,400
Flow Switch	2	EA	$50	$100	$470	$940	$1,040
Space Temperature (Thermostat)	10	EA	$83	$832	$527	$5,268	$6,100
Supply Air Temperature	3	EA	$67	$200	$273	$820	$1,020
Return Air Temperature	1	EA	$67	$67	$273	$273	$340
Pressure Sensor	3	EA	$83	$249	$485	$1,455	$1,704
Position Sensor	11	EA	$67	$732	$300	$3,300	$4,032
Steam Pressure	4	EA	$67	$268	$873	$3,492	$3,760
Flow	4	EA	$83	$333	$2,117	$8,467	$8,800
Glycol Temperature	2	EA	$67	$133	$533	$1,067	$1,200
Outside Air Temperature	4	EA	$67	$266	$273	$1,094	$1,360
High Limit	4	EA	$50	$200	$270	$1,080	$1,280
Low Limit	6	EA	$50	$300	$270	$1,621	$1,921
DDC Control Unit - 32 Point	3	EA	$750	$2,250	$4,250	$12,750	$15,000
Subtotal Buildings 117-10 & 11	94	Sensors/Cntrls		**$7,989**		**$53,189**	**$61,177**
Nevada Sales Tax	3.75%	%		-		$1,995	$1,995
Subtotal							$63,172
Contractor OH & Profit	25.0%	%					$15,793
Subtotal							$78,965
Bond	1.5%	%					$1,184
Subtotal							$80,150
Estimating Contingency	10.0%	%					$8,015
Total Probable Construction Cost							**$88,164**

Avoided Cost of Pneumatic Controls Repair	**$7,989**	**$45,210**	**$74,246**

CONSTRUCTION COST ESTIMATE					Date Prepared November-94		Sheet 1 of 1
Project ECIP Facility Energy Improvements				Project No.	Basis for Estimate Code A (no design competed)		
Location Western Area Demilitarization Facility (WADF) Hawthorne Army Ammunition Plant, Nevada							
Engineer-Architect Keller & Gannon							
Drawing No. Install Air Curtains at Roll-up Doors			Estimator B. I. Horst		Checked By R. C. Lennig		
Line Item	Quantity		Labor		Material		Total
	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	Cost
Building 117-5 Refining Building - Air Curtains							
Mars (or equal) Model No. C-60C Air Curtain (2 Each per Roll-up Door)	3	Doors	$1,727	$5,182	$2,391	$7,173	$12,356
Door Switch, Explosion Proof	3	EA	$42	$125	$45	$135	$260
Wiring & Conduit, Explosion Proof	100	LF	$5.16	$516	$1.90	$190	$706
Motor Started (Mechanical Room)	3	EA	$83	$249	$94	$282	$531
Subtotal Bldg 117-5 Air Curtains				$6,072		$7,780	$13,853
Nevada Sales Tax	3.75%	%		-		$292	$292
Subtotal							$14,144
Contractor OH & Profit	25.0%	%					$3,536
Subtotal							$17,680
Bond	1.5%	%					$265
Subtotal							$17,946
Estimating Contingency	10.0%	%					$1,795
Total Probable Construction Cost - Building 117-5 Air Curtains							**$19,740**
Building 117-6 Steamout Building - DDC Controls Retrofit							
Mars (or equal) Model No. C-60C Air Curtain (2 Each per Roll-up Door)	2	Doors	$1,727	$3,455	$2,391	$4,782	$8,237
Door Switch, Explosion Proof	2	EA	$42	$83	$45	$90	$173
Wiring & Conduit, Explosion Proof	150	LF	$5.16	$773	$1.90	$285	$1,058
Motor Started (Mechanical Room)	2	EA	$83	$166	$94	$188	$354
Subtotal Bldg 117-6 Air Curtains				$4,478		$5,345	$9,823
Nevada Sales Tax	3.75%	%		-		$200	$200
Subtotal							$10,024
Contractor OH & Profit	25.0%	%					$2,506
Subtotal							$12,529
Bond	1.5%	%					$188
Subtotal							$12,717
Estimating Contingency	10.0%	%					$1,272
Total Probable Construction Cost - Building 117-6 Air Curtains							**$13,989**

CONSTRUCTION COST ESTIMATE					Date Prepared November-94		Sheet 1 of 3
Project ECIP Facility Energy Improvements				Project No.	Basis for Estimate Code A (no design competed)		
Location Western Area Demilitarization Facility (WADF) Hawthorne Army Ammunition Plant, Nevada							
Engineer-Architect Keller & Gannon							
Drawing No. Exhaust Air Heat Recovery Retrofit			Estimator B. I. Horst		Checked By R. C. Lennig		
Line Item	Quantity		Labor		Material		Total
	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	Cost
Building 117-3 Decontamination of Small Parts Building - Exhaust Air Heat Recovery - Run-Around Loop							
Exhst Coil: 12" x 12", 3/8" x 0.016" Tube, 0.0065 Al, 2 Row, 8 Fin/Inch	4	EA	$39	$155	$331	$1,325	$1,480
Exhst Coil: 10" x 12", 3/8" x 0.016" Tube, 0.0065 Al, 2 Row, 8 Fin/Inch	2	EA	$32	$64	$318	$636	$700
SA Coil: 30" x 90", 1/2" x 0.017" Tube, 0.0065 Al, 2 Row, 8 Fin/Inch	2	EA	$732	$1,463	$868	$1,737	$3,200
Copper Pipe, 3/4", Type K, including 10% allowance for fittings	386	LF	$4.36	$1,683	$2.72	$1,049	$2,732
Fiberglass Insulation, 1-1/2" Wall, 3/4" Pipe, All Service Jacket	386	LF	$2.78	$1,073	$1.35	$521	$1,594
Aluminum Jacket, 0.016"	379	SF	$5.10	$1,933	$0.56	$213	$2,146
Circulating Pump: 1/8 HP	1	EA	$102	$102	$464.42	$464	$566
Thermostatic Pump Control, DDC	1	EA	$41.58	$42	$215.11	$215	$257
Wiring & Conduit	40	LF	$5.16	$206	$1.90	$76	$282
Motor Starter (Mechanical Room)	1	EA	$83	$83	$94	$94	$177
Subtotal Bldg 117-5 Run Around Loop				$6,804		$6,330	$13,134
Nevada Sales Tax	3.75%	%		-		$237	$237
Subtotal							$13,371
Contractor OH & Profit	25.0%	%					$3,343
Subtotal							$16,714
Bond	1.5%	%					$251
Subtotal							$16,965
Estimating Contingency	10.0%	%					$1,696
Total Probable Construction Cost - Building 117-3 Run Around Loop							**$18,661**

CONSTRUCTION COST ESTIMATE					Date Prepared November-94		Sheet 2 of 3
Project ECIP Facility Energy Improvements				Project No.	Basis for Estimate		
Location Western Area Demilitarization Facility (WADF) Hawthorne Army Ammunition Plant, Nevada					Code A (no design competed)		
Engineer-Architect Keller & Gannon							
Drawing No. Exhaust Air Heat Recovery Retrofit			Estimator B. I. Horst		Checked By R. C. Lennig		
Line Item	Quantity		Labor		Material		Total
	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	Cost
Building 117-5 Refining Building - Exhaust Air Heat Recovery - Run-Around Loop							
Exhst Coil: 24" x 48", 3/8" x 0.016" Tube, 0.0065 Al, 2 Row, 8 Fin/Inch	8	EA	$311	$2,485	$649	$5,195	$7,680
Exhst Coil: 16" x 48", 3/8" x 0.016" Tube, 0.0065 Al, 2 Row, 8 Fin/Inch	2	EA	$207	$414	$533	$1,066	$1,480
SA Coil: 42.5" x 105", 1/2" x 0.017" Tube, 0.0065 Al, 2 Row, 8 Fin/Inch	1	EA	$1,196	$1,196	$1,279	$1,279	$2,475
Copper Pipe, 3/4", Type K, including 10% allowance for fittings	722	LF	$4.36	$3,146	$2.72	$1,960	$5,106
Fiberglass Insulation, 1-1/2" Wall, 3/4" Pipe, All Service Jacket	722	LF	$2.78	$2,005	$1.35	$974	$2,979
Aluminum Jacket, 0.016"	708	SF	$5.10	$3,613	$0.56	$397	$4,010
Circulating Pump: 1/8 HP	1	EA	$102	$102	$464.42	$464	$566
Thermostatic Pump Control, DDC	1	EA	$41.58	$42	$215.11	$215	$257
Wiring & Conduit	50	LF	$5.16	$258	$1.90	$95	$353
Motor Starter (Mechanical Room)	1	EA	$83	$83	$94	$94	$177
Subtotal Bldg 117-5 Run Around Loop				$13,344		$11,739	$25,083
Nevada Sales Tax	3.75%	%		-		$440	$440
Subtotal							$25,523
Contractor OH & Profit	25.0%	%					$6,381
Subtotal							$31,904
Bond	1.5%	%					$479
Subtotal							$32,383
Estimating Contingency	10.0%	%					$3,238
Total Probable Construction Cost - Building 117-5 Run Around Loop							**$35,621**

CONSTRUCTION COST ESTIMATE					Date Prepared November-94		Sheet 3 of 3
Project ECIP Facility Energy Improvements				Project No.	Basis for Estimate		
Location Western Area Demilitarization Facility (WADF) Hawthorne Army Ammunition Plant, Nevada					Code A (no design competed)		
Engineer-Architect Keller & Gannon							
Drawing No. Exhaust Air Heat Recovery Retrofit		Estimator B. I. Horst			Checked By R. C. Lennig		
Line Item	Quantity		Labor		Material		Total
	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	Cost
Building 117-6 Steamout Building - Exhaust Air Heat Recovery - Run-Around Loop							
Exhst Coil: 24" x 48", 3/8" x 0.016" Tube, 0.0065 Al, 2 Row, 8 Fin/Inch	14	EA	$311	$4,348	$649	$9,092	$13,440
Exhst Coil: 16" x 16", 3/8" x 0.016" Tube, 0.0065 Al, 2 Row, 8 Fin/Inch	8	EA	$69	$554	$366	$2,926	$3,480
SA Coil: 42.5" x 105", 1/2" x 0.017" Tube, 0.0065 Al, 2 Row, 8 Fin/Inch	2	EA	$1,196	$2,393	$1,279	$2,557	$4,950
Copper Pipe, 3/4", Type K, including 10% allowance for fittings	1,300	LF	$4.36	$5,669	$2.72	$3,531	$9,200
Fiberglass Insulation, 1-1/2" Wall, 3/4" Pipe, All Service Jacket	1,300	LF	$2.78	$3,613	$1.35	$1,755	$5,368
Aluminum Jacket, 0.016"	1,276	SF	$5.10	$6,510	$0.56	$716	$7,226
Circulating Pump: 1/8 HP	2	EA	$102	$203	$464.42	$929	$1,132
Thermostatic Pump Control, DDC	2	EA	$41.58	$83	$215.11	$430	$513
Wiring & Conduit	80	LF	$5.16	$412	$1.90	$152	$564
Motor Starter (Mechanical Room)	2	EA	$83	$166	$94	$188	$354
Subtotal Bldg 117-6 Run Around Loops				$23,953		$22,276	$46,228
Nevada Sales Tax	3.75%	%		-		$835	$835
Subtotal							$47,064
Contractor OH & Profit	25.0%	%					$11,766
Subtotal							$58,829
Bond	1.5%	%					$882
Subtotal							$59,712
Estimating Contingency	10.0%	%					$5,971
Total Probable Construction Cost - Building 117-6 Run Around Loop							**$65,683**

CONSTRUCTION COST ESTIMATE					Date Prepared March-95		Sheet 1 of 1
Project ECIP Facility Energy Improvements					Project No.	Basis for Estimate Code A (no design competed)	
Location Western Area Demilitarization Facility (WADF) Hawthorne Army Ammunition Plant, Nevada							
Engineer-Architect Keller & Gannon							
Drawing No. Wall Insulation Retrofits			Estimator B. I. Horst			Checked By R. C. Lennig	
Line Item	Quantity		Labor		Material		Total Cost
	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	
Building 117-3 Decontamination of Small Parts Building - Wall Insulation Retrofit							
Fiberglass, Unaced Insulation 6" Thick, R19, 23" Wide Batts	4,360	SF	$0.14	$605	$0.30	$1,290	$1,895
Steel Siding, Colored, Ribbed, on Steel Frame, 10 Yr Finish, 22 gauge	4,360	SF	$0.95	$4,142	$1.29	$5,622	$9,764
Steel Furring 6" Deep, 24" O.C.	4,360	SF	$0.59	$2,589	$0.27	$1,198	$3,787
Siding Window and Door Trim Moldings and Caulking	216	LF	$0.99	$215	$0.36	$78	$292
Subtotal Bldg 117-3 Wall Insulation				$7,550		$8,188	$15,738
Nevada Sales Tax	3.75%	%		-		$307	$307
Subtotal							$16,045
Contractor OH & Profit	25.0%	%					$4,011
Subtotal							$20,057
Bond	1.5%	%					$301
Subtotal							$20,358
Estimating Contingency	10.0%	%					$2,036
Total Probable Construction Cost - Building 117-3 Wall Insulation							**$22,393**
Building 117-5 Refining Building - Wall Insulation Retrofit							
Fiberglass, Unaced Insulation 6" Thick, R19, 23" Wide Batts	11,420	SF	$0.14	$1,585	$0.30	$3,380	$4,964
Steel Siding, Colored, Ribbed, on Steel Frame, 10 Yr Finish, 22 gauge	11,420	SF	$0.95	$10,850	$1.29	$14,727	$25,577
Steel Furring 6" Deep, 24" O.C.	11,420	SF	$0.59	$6,782	$0.27	$3,139	$9,921
Siding Window and Door Trim Moldings and Caulking	1,524	LF	$0.99	$1,515	$0.36	$548	$2,063
Subtotal Bldg 117-5 Wall Insulation				$20,732		$21,793	$42,525
Nevada Sales Tax	3.75%	%		-		$817	$817
Subtotal							$43,342
Contractor OH & Profit	25.0%	%					$10,836
Subtotal							$54,178
Bond	1.5%	%					$813
Subtotal							$54,991
Estimating Contingency	10.0%	%					$5,499
Total Probable Construction Cost - Building 117-5 Wall Insulation							**$60,490**

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location: Hawthorne Army Ammunition Plant Region No. 4 Project No.
Western Area Demilitarization Facility (WADF), Nevada
Project Title: ECIP Facility Energy Improvements Fiscal Year FY97
Bldgs 117-1, 3, 4, 5, 6, 8, 10 & 11 HVAC System DDC Controls Retrofits (Total Project)
Analysis Date: November 1994 Economic Life: 10 Years Preparer: KELLER & GANNON

1. Investment Costs

A. Construction Costs	$660,077		
B. SIOH	$ 39,605		
C. Design Cost	$ 39,605		
D. Total Cost (1A+1B+1C)	$ 739,286		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$739,286

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU(1)	Saving MBTU/Yr(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$12.82	331		$4,242	8.58	$36,400
B. Dist	$6.13	4,779		$29,286	9.62	$281,734
C. LPG	-	-				
D. Other	-	-				
E. Elec Demand	$102.21	60.8	kW	$6,214	8.58	$53,317
F. Total		5,110		$39,743		$371,451

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	42,079		
(1) Discount Factor (Table A)		8.53	
(2) Discounted Savings/Cost (3A x 3A1)			$358,934

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+) Cost(-) (4)
a.	$566,068	0	1.00	$566,068
b.				
c.				
d. Total	$566,068			$566,068

C Total Non Energy Discounted Savings (3A2+3Bd4) $925,002

4. First Year Dollar Savings (2F3+3A+(3Bd1/Years Economic Life)):	$138,429	
5. Simple Payback (1G/4):	5.34	Years
6. Total Net Discounted Savings (2F5+3C):	$1,296,453	
7. Savings to Investment Ratio (SIR) 6/1G:	1.75	

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location: Hawthorne Army Ammunition Plant Region No. 4 Project No.
Western Area Demilitarization Facility (WADF), Nevada
Project Title: ECIP Facility Energy Improvements Fiscal Year FY97
Bldg 117-1 HVAC System DDC Controls Retrofit
Analysis Date: November 1994 Economic Life: 10 Years Preparer: KELLER & GANNON

1. Investment Costs			
A. Construction Costs	$93,849		
B. SIOH	$ 5,631		
C. Design Cost	$ 5,631		
D. Total Cost (1A+1B+1C)	$ 105,111		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$105,111

2. Energy Savings (+)/Cost(-):
Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU(1)	Saving MBTU/Yr(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$12.82	66.1		$848	8.58	$7,273
B. Dist	$6.13	320		$1,959	9.62	$18,848
C. LPG	-	-				
D. Other	-	-				
E. Elec Demand	$102.21	7.6	kW	$777	8.58	$6,665
F. Total		386		$3,584		$32,786

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$5,738		
(1) Discount Factor (Table A)		8.53	
(2) Discounted Savings/Cost (3A x 3A1)			$48,945

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+) Cost(-) (4)
a.	$82,483	0	1.00	$82,483
b.				
c.				
d. Total	$82,483			$82,483

C Total Non Energy Discounted Savings (3A2+3Bd4) $131,428

4. First Year Dollar Savings (2F3+3A+(3Bd1/Years Economic Life)):	$17,570	
5. Simple Payback (1G/4):	5.98	Years
6. Total Net Discounted Savings (2F5+3C):	$164,214	
7. Savings to Investment Ratio (SIR) 6/1G:	1.56	

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location: Hawthorne Army Ammunition Plant Region No. 4 Project No.
Western Area Demilitarization Facility (WADF), Nevada
Project Title: ECIP Facility Energy Improvements Fiscal Year FY97
Bldg 117-3 HVAC System DDC Controls Retrofit
Analysis Date: November 1994 Economic Life: 10 Years Preparer: KELLER & GANNON

1. Investment Costs			
A. Construction Costs	$82,376		
B. SIOH	$ 4,943		
C. Design Cost	$ 4,943		
D. Total Cost (1A+1B+1C)	$ 92,261		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$92,261

2. Energy Savings (+)/Cost(-):
Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU(1)	Saving MBTU/Yr(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$12.82	10.1		$129	8.58	$1,107
B. Dist	$6.13	89.9		$551	9.62	$5,303
C. LPG	-	-				
D. Other	-	-				
E. Elec Demand	$102.21	7.6	kW	$777	8.58	$6,665
F. Total		100.0		$1,457		$13,074

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$5,738		
(1) Discount Factor (Table A)		8.53	
(2) Discounted Savings/Cost (3A x 3A1)			$48,945

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+) Cost(-) (4)
a.	$76,208	0	1.00	$76,208
b.				
c.				
d. Total	$76,208			$76,208

C Total Non Energy Discounted Savings (3A2+3Bd4) $125,154

4. First Year Dollar Savings (2F3+3A+(3Bd1/Years Economic Life)):	$14,816	
5. Simple Payback (1G/4):	6.23	Years
6. Total Net Discounted Savings (2F5+3C):	$138,228	
7. Savings to Investment Ratio (SIR) 6/1G:	1.50	

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location: Hawthorne Army Ammunition Plant Region No. 4 Project No.
Western Area Demilitarization Facility (WADF), Nevada
Project Title: ECIP Facility Energy Improvements Fiscal Year FY97
Bldg 117-4 HVAC System DDC Controls Retrofit
Analysis Date: November 1994 Economic Life: 10 Years Preparer: KELLER & GANNON

1. Investment Costs

A. Construction Costs	$79,491		
B. SIOH	$ 4,769		
C. Design Cost	$ 4,769		
D. Total Cost (1A+1B+1C)	$ 89,030		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$89,030

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU(1)	Saving MBTU/Yr(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$12.82	8.2		$105	8.58	$900
B. Dist	$6.13	47.4		$291	9.62	$2,795
C. LPG	-	-				
D. Other	-	-				
E. Elec Demand	$102.21	7.6	kW	$777	8.58	$6,665
F. Total		55.6		$1,172		$10,359

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$5,738		
(1) Discount Factor (Table A)		8.53	
(2) Discounted Savings/Cost (3A x 3A1)			$48,945

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+) Cost(-) (4)
a.	$66,958	0	1.00	$66,958
b.				
c.				
d. Total	$66,958			$66,958

C Total Non Energy Discounted Savings (3A2+3Bd4) $115,904

4. First Year Dollar Savings (2F3+3A+(3Bd1/Years Economic Life)):	$13,606	
5. Simple Payback (1G/4):	6.54	Years
6. Total Net Discounted Savings (2F5+3C):	$126,263	
7. Savings to Investment Ratio (SIR) 6/1G:	1.42	

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location: Hawthorne Army Ammunition Plant Region No. 4 Project No.
Western Area Demilitarization Facility (WADF), Nevada
Project Title: ECIP Facility Energy Improvements Fiscal Year FY97
Bldg 117-5 HVAC System DDC Controls Retrofit
Analysis Date: November 1994 Economic Life: 10 Years Preparer: KELLER & GANNON

1. Investment Costs

A. Construction Costs	$65,621		
B. SIOH	$ 3,937		
C. Design Cost	$ 3,937		
D. Total Cost (1A+1B+1C)	$ 73,496		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$73,496

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU(1)	Saving MBTU/Yr(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$12.82	93.3		$1,196	8.58	$10,261
B. Dist	$6.13	1,676		$10,273	9.62	$98,823
C. LPG	-	-				
D. Other	-	-				
E. Elec Demand	$102.21	7.6	kW	$777	8.58	$6,665
F. Total		1,770		$12,245		$115,749

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$3,825		
(1) Discount Factor (Table A)		8.53	
(2) Discounted Savings/Cost (3A x 3A1)			$32,630

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+) Cost(-) (4)
a.	$55,166	0	1.00	$55,166
b.				
c.				
d. Total	$55,166			$55,166

C Total Non Energy Discounted Savings (3A2+3Bd4) $87,797

4. First Year Dollar Savings (2F3+3A+(3Bd1/Years Economic Life)):	$21,587	
5. Simple Payback (1G/4):	3.40	Years
6. Total Net Discounted Savings (2F5+3C):	$203,546	
7. Savings to Investment Ratio (SIR) 6/1G:	2.77	

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location: Hawthorne Army Ammunition Plant Region No. 4 Project No.
Western Area Demilitarization Facility (WADF), Nevada
Project Title: ECIP Facility Energy Improvements Fiscal Year FY97
Bldg 117-6 HVAC System DDC Controls Retrofit
Analysis Date: November 1994 Economic Life: 10 Years Preparer: KELLER & GANNON

1. Investment Costs

A. Construction Costs	$164,369		
B. SIOH	$ 9,862		
C. Design Cost	$ 9,862		
D. Total Cost (1A+1B+1C)	$ 184,094		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$184,094

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU(1)	Saving MBTU/Yr(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$12.82	140.4		$1,800	8.58	$15,448
B. Dist	$6.13	2,560		$15,689	9.62	$150,933
C. LPG	-	-				
D. Other	-	-				
E. Elec Demand	$102.21	15.2	kW	$1,554	8.58	$13,329
F. Total		2,701		$19,043		$179,710

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$9,563		
(1) Discount Factor (Table A)		8.53	
(2) Discounted Savings/Cost (3A x 3A1)			$81,576

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+) Cost(-) (4)
a.	$138,412	0	1.00	$138,412
b.				
c.				
d. Total	$138,412			$138,412

C Total Non Energy Discounted Savings (3A2+3Bd4) $219,988

4. First Year Dollar Savings (2F3+3A+(3Bd1/Years Economic Life)):	$42,448	
5. Simple Payback (1G/4):	4.34	Years
6. Total Net Discounted Savings (2F5+3C):	$399,698	
7. Savings to Investment Ratio (SIR) 6/1G:	2.17	

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location: Hawthorne Army Ammunition Plant Region No. 4 Project No.
Western Area Demilitarization Facility (WADF), Nevada
Project Title: ECIP Facility Energy Improvements Fiscal Year FY97
Bldg 117-8 HVAC System DDC Controls Retrofit
Analysis Date: November 1994 Economic Life: 10 Years Preparer: KELLER & GANNON

1. Investment Costs

A. Construction Costs	$86,205		
B. SIOH	$ 5,172		
C. Design Cost	$ 5,172		
D. Total Cost (1A+1B+1C)	$ 96,549		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$96,549

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU(1)	Saving MBTU/Yr(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$12.82	6.2		$80	8.58	$687
B. Dist	$6.13	52		$318	9.62	$3,059
C. LPG	-	-				
D. Other	-	-				
E. Elec Demand	$102.21	7.6	kW	$777	8.58	$6,665
F. Total		58		$1,175		$10,410

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$5,738		
(1) Discount Factor (Table A)		8.53	
(2) Discounted Savings/Cost (3A x 3A1)			$48,945

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+) Cost(-) (4)
a.	$72,594	0	1.00	$72,594
b.				
c.				
d. Total	$72,594			$72,594

C Total Non Energy Discounted Savings (3A2+3Bd4) $121,540

4. First Year Dollar Savings (2F3+3A+(3Bd1/Years Economic Life)):	$14,172	
5. Simple Payback (1G/4):	6.81	Years
6. Total Net Discounted Savings (2F5+3C):	$131,950	
7. Savings to Investment Ratio (SIR) 6/1G:	1.37	

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location: Hawthorne Army Ammunition Plant Region No. 4 Project No.
Western Area Demilitarization Facility (WADF), Nevada
Project Title: ECIP Facility Energy Improvements Fiscal Year FY97
Bldgs 117-10 & 117-11 HVAC System DDC Controls Retrofits
Analysis Date: November 1994 Economic Life: 10 Years Preparer: KELLER & GANNON

1. Investment Costs

A. Construction Costs	$88,164		
B. SIOH	$ 5,290		
C. Design Cost	$ 5,290		
D. Total Cost (1A+1B+1C)	$ 98,744		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$98,744

2. Energy Savings (+)/Cost(-):
Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU(1)	Saving MBTU/Yr(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$12.82	6.6		$84	8.58	$723
B. Dist	$6.13	33		$205	9.62	$1,974
C. LPG	-	-				
D. Other	-	-				
E. Elec Demand	$102.21	7.6	kW	$777	8.58	$6,665
F. Total		40		$1,066		$9,362

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$5,738		
(1) Discount Factor (Table A)		8.53	
(2) Discounted Savings/Cost (3A x 3A1)			$48,945

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+) Cost(-) (4)
a.	$74,246	0	1.00	$74,246
b.				
c.				
d. Total	$74,246			$74,246

C Total Non Energy Discounted Savings (3A2+3Bd4) $123,192

4. First Year Dollar Savings (2F3+3A+(3Bd1/Years Economic Life)):	$14,229	
5. Simple Payback (1G/4):	6.94	Years
6. Total Net Discounted Savings (2F5+3C):	$132,553	
7. Savings to Investment Ratio (SIR) 6/1G:	1.34	

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location: Hawthorne Army Ammunition Plant Region No. 4 Project No.
Western Area Demilitarization Facility (WADF), Nevada
Project Title: ECIP Facility Energy Improvements Fiscal Year FY97
Bldgs 117-5 & 117-6: Install Air Curtains on Roll-Up Doors (Total Project)
Analysis Date: November 1994 Economic Life: 20 Years Preparer: KELLER & GANNON

1. Investment Costs

A. Construction Costs	$33,729		
B. SIOH	$ 2,024		
C. Design Cost	$ 2,024		
D. Total Cost (1A+1B+1C)	$ 37,777		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$37,777

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU(1)	Saving MBTU/Yr(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$12.82	(94.9)		($1,216)	15.08	($18,341)
B. Dist	$6.13	1,218.2		$7,466	18.57	$138,638
C. LPG	-	-				
D. Other	-	-				
E. Elec Demand	$102.21	(4.95)	kW	($505)	15.08	($7,622)
F. Total		1123.4		$5,744		$112,676

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	($41.58)		
(1) Discount Factor (Table A)		14.88	
(2) Discounted Savings/Cost (3A x 3A1)			($619)

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+) Cost(-) (4)
a.				
b.				
c.				
d. Total	$0			$0

C Total Non Energy Discounted Savings (3A2+3Bd4)	($619)	
4. First Year Dollar Savings (2F3+3A+(3Bd1/Years Economic Life)):	$5,702	
5. Simple Payback (1G/4):	6.62	Years
6. Total Net Discounted Savings (2F5+3C):	$112,057	
7. Savings to Investment Ratio (SIR) 6/1G:	2.97	

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location: Hawthorne Army Ammunition Plant Region No. 4 Project No.
Western Area Demilitarization Facility (WADF), Nevada
Project Title: ECIP Facility Energy Improvements Fiscal Year FY97
Bldg 117-5: Install Air Curtains on Roll-Up Doors
Analysis Date: November 1994 Economic Life: 20 Years Preparer: KELLER & GANNON

1. Investment Costs

A. Construction Costs	$19,740		
B. SIOH	$ 1,184		
C. Design Cost	$ 1,184		
D. Total Cost (1A+1B+1C)	$ 22,109		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$22,109

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU(1)	Saving MBTU/Yr(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$12.82	(39.3)		($503)	15.08	($7,593)
B. Dist	$6.13	504.3		$3,091	18.57	$57,393
C. LPG	-	-				
D. Other	-	-				
E. Elec Demand	$102.21	(2.97)	kW	($303)	15.08	($4,573)
F. Total		465.0		$2,284		$45,227

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	($21)		
(1) Discount Factor (Table A)		14.88	
(2) Discounted Savings/Cost (3A x 3A1)			($309)

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+) Cost(-) (4)
a.				
b.				
c.				
d. Total	$0			$0

C Total Non Energy Discounted Savings (3A2+3Bd4) ($309)

4. First Year Dollar Savings (2F3+3A+(3Bd1/Years Economic Life)):	$2,263	
5. Simple Payback (1G/4):	9.77	Years
6. Total Net Discounted Savings (2F5+3C):	$44,918	
7. Savings to Investment Ratio (SIR) 6/1G:	2.03	

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location: Hawthorne Army Ammunition Plant Region No. 4 Project No.
Western Area Demilitarization Facility (WADF), Nevada
Project Title: ECIP Facility Energy Improvements Fiscal Year FY97
Bldg 117-6: Install Air Curtains on Roll-Up Doors
Analysis Date: November 1994 Economic Life: 20 Years Preparer: KELLER & GANNON

1. Investment Costs			
A. Construction Costs	$13,989		
B. SIOH	$ 839		
C. Design Cost	$ 839		
D. Total Cost (1A+1B+1C)	$ 15,668		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$15,668

2. Energy Savings (+)/Cost(-):
Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU(1)	Saving MBTU/Yr(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$12.82	(55.6)		($713)	15.08	($10,748)
B. Dist	$6.13	713.9		$4,375	18.57	$81,245
C. LPG	-	-				
D. Other	-	-				
E. Elec Demand	$102.21	(1.98)	kW	($202)	15.08	($3,049)
F. Total		658.3		$3,460		$67,449

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	($21)		
(1) Discount Factor (Table A)		14.88	
(2) Discounted Savings/Cost (3A x 3A1)			($309)

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+) Cost(-) (4)
a.				
b.				
c.				
d. Total	$0			$0

C Total Non Energy Discounted Savings (3A2+3Bd4)	($309)	
4. First Year Dollar Savings (2F3+3A+(3Bd1/Years Economic Life)):	$3,439	
5. Simple Payback (1G/4):	4.56	Years
6. Total Net Discounted Savings (2F5+3C):	$67,139	
7. Savings to Investment Ratio (SIR) 6/1G:	4.29	

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location: Hawthorne Army Ammunition Plant Region No. 4 Project No.
Western Area Demilitarization Facility (WADF), Nevada
Project Title: ECIP Facility Energy Improvements Fiscal Year FY97
Bldg 117-5 & 117-6: Install Exhaust Air Heat Recovery Run Around Loop (Total Project)
Analysis Date: November 1994 Economic Life: 20 Years Preparer: KELLER & GANNON

1. Investment Costs			
A. Construction Costs	$101,304		
B. SIOH	$ 6,078		
C. Design Cost	$ 6,078		
D. Total Cost (1A+1B+1C)	$ 113,461		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$113,461

2. Energy Savings (+)/Cost(-):
Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU(1)	Saving MBTU/Yr(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$12.82	12.8		$165	15.08	$2,483
B. Dist	$6.13	3,997.0		$24,495	18.57	$454,872
C. LPG	-	-				
D. Other	-	-				
E. Elec Demand	$102.21	(0.28)	kW	($29)	15.08	($431)
F. Total		4,009.9		$24,631		$456,924

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	($2,032)		
(1) Discount Factor (Table A)		14.88	
(2) Discounted Savings/Cost (3A x 3A1)			($30,234)

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+) Cost(-) (4)
a.				
b.				
c.				
d. Total	$0			$0

C Total Non Energy Discounted Savings (3A2+3Bd4)	($30,234)	
4. First Year Dollar Savings (2F3+3A+(3Bd1/Years Economic Life)):	$22,599	
5. Simple Payback (1G/4):	5.02	Years
6. Total Net Discounted Savings (2F5+3C):	$426,690	
7. Savings to Investment Ratio (SIR) 6/1G:	3.76	

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location: Hawthorne Army Ammunition Plant Region No. 4 Project No.
Western Area Demilitarization Facility (WADF), Nevada
Project Title: ECIP Facility Energy Improvements Fiscal Year FY97
Bldg 117-3: Install Exhaust Air Heat Recovery Run Around Loop
Analysis Date: November 1994 Economic Life: 20 Years Preparer: KELLER & GANNON

1. Investment Costs			
A. Construction Costs	$18,661		
B. SIOH	$ 1,120		
C. Design Cost	$ 1,120		
D. Total Cost (1A+1B+1C)	$ 20,901		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$20,901

2. Energy Savings (+)/Cost(-):
Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU(1)	Saving MBTU/Yr(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$12.82	(1.7)		($22)	15.08	($332)
B. Dist	$6.13	124.3		$762	18.57	$14,146
C. LPG	-	-				
D. Other	-	-				
E. Elec Demand	$102.21	(0.09)	kW	($10)	15.08	($144)
F. Total		122.6		$730		$13,670

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	($677)		
(1) Discount Factor (Table A)		14.88	
(2) Discounted Savings/Cost (3A x 3A1)			($10,078)

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+) Cost(-) (4)
a.				
b.				
c.				
d. Total	$0			$0

C Total Non Energy Discounted Savings (3A2+3Bd4)	($10,078)	
4. First Year Dollar Savings (2F3+3A+(3Bd1/Years Economic Life)):	$53	
5. Simple Payback (1G/4):	394.75	Years
6. Total Net Discounted Savings (2F5+3C):	$3,593	
7. Savings to Investment Ratio (SIR) 6/1G:	0.17	

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location: Hawthorne Army Ammunition Plant Region No. 4 Project No.
Western Area Demilitarization Facility (WADF), Nevada
Project Title: ECIP Facility Energy Improvements Fiscal Year FY97
Bldg 117-5: Install Exhaust Air Heat Recovery Run Around Loop
Analysis Date: November 1994 Economic Life: 20 Years Preparer: KELLER & GANNON

1. Investment Costs

A. Construction Costs	$35,621		
B. SIOH	$ 2,137		
C. Design Cost	$ 2,137		
D. Total Cost (1A+1B+1C)	$ 39,896		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$39,896

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU(1)	Saving MBTU/Yr(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$12.82	6.0		$77	15.08	$1,164
B. Dist	$6.13	1,511		$9,262	18.57	$171,992
C. LPG	-	-				
D. Other	-	-				
E. Elec Demand	$102.21	(0.09)	kW	($10)	15.08	($144)
F. Total		1,517		$9,329		$173,012

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	($677)	
(1) Discount Factor (Table A)		14.88
(2) Discounted Savings/Cost (3A x 3A1)		($10,078)

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+) Cost(-) (4)
a.				
b.				
c.				
d. Total	$0			$0

C Total Non Energy Discounted Savings (3A2+3Bd4) ($10,078)

4. First Year Dollar Savings (2F3+3A+(3Bd1/Years Economic Life)):	$8,652	
5. Simple Payback (1G/4):	4.61	Years
6. Total Net Discounted Savings (2F5+3C):	$162,934	
7. Savings to Investment Ratio (SIR) 6/1G:	4.08	

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location: Hawthorne Army Ammunition Plant Region No. 4 Project No.
Western Area Demilitarization Facility (WADF), Nevada
Project Title: ECIP Facility Energy Improvements Fiscal Year FY97
Bldg 117-6: Install Exhaust Air Heat Recovery Run Around Loop
Analysis Date: November 1994 Economic Life: 20 Years Preparer: KELLER & GANNON

1. Investment Costs			
A. Construction Costs	$65,683		
B. SIOH	$ 3,941		
C. Design Cost	$ 3,941		
D. Total Cost (1A+1B+1C)	$ 73,565		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$73,565

2. Energy Savings (+)/Cost(-):
Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU(1)	Saving MBTU/Yr(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$12.82	6.8		$87	15.08	$1,319
B. Dist	$6.13	2,486		$15,233	18.57	$282,880
C. LPG	-	-				
D. Other	-	-				
E. Elec Demand	$102.21	(0.19)	kW	($19)	15.08	($287)
F. Total		2,493		$15,302		$283,912

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	($1,355)		
(1) Discount Factor (Table A)		14.88	
(2) Discounted Savings/Cost (3A x 3A1)			($20,156)

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+) Cost(-) (4)
a.				
b.				
c.				
d. Total	$0			$0

C Total Non Energy Discounted Savings (3A2+3Bd4)	($20,156)	
4. First Year Dollar Savings (2F3+3A+(3Bd1/Years Economic Life)):	$13,947	
5. Simple Payback (1G/4):	5.27	Years
6. Total Net Discounted Savings (2F5+3C):	$263,756	
7. Savings to Investment Ratio (SIR) 6/1G:	3.59	

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location: Hawthorne Army Ammunition Plant Region No. 4 Project No.
Western Area Demilitarization Facility (WADF), Nevada
Project Title: ECIP Facility Energy Improvements Fiscal Year FY96
Bldg 117-3: Install Exterior Wall Insulation and Metal Siding
Analysis Date: March 1995 Economic Life: 20 Years Preparer: KELLER & GANNON

1. Investment Costs			
A. Construction Costs	$22,393		
B. SIOH	$ 1,344		
C. Design Cost	$ 1,344		
D. Total Cost (1A+1B+1C)	$ 25,081		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$25,081

2. Energy Savings (+)/Cost(-):
Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU(1)	Saving MBTU/Yr(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$12.82	(3.9)		($50)	15.08	($761)
B. Dist	$6.13	94.4		$579	18.57	$10,746
C. LPG	-	-				
D. Other	-	-				
E. Elec Demand	$102.21	0.00	kW	$0	15.08	$0
F. Total		90		$528		$9,985

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$0		
(1) Discount Factor (Table A)		14.88	
(2) Discounted Savings/Cost (3A x 3A1)			$0

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+) Cost(-) (4)
a.				
b.				
c.				
d. Total	$0			$0

C Total Non Energy Discounted Savings (3A2+3Bd4)	$0	
4. First Year Dollar Savings (2F3+3A+(3Bd1/Years Economic Life)):	$528	
5. Simple Payback (1G/4):	47.48	Years
6. Total Net Discounted Savings (2F5+3C):	$9,985	
7. Savings to Investment Ratio (SIR) 6/1G:	0.40	

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location: Hawthorne Army Ammunition Plant Region No. 4 Project No.
Western Area Demilitarization Facility (WADF), Nevada
Project Title: ECIP Facility Energy Improvements Fiscal Year FY96
Bldg 117-5: Install Exterior Wall Insulation and Metal Siding
Analysis Date: February 1995 Economic Life: 20 Years Preparer: KELLER & GANNON

1. Investment Costs			
A. Construction Costs	$60,490		
B. SIOH	$ 3,629		
C. Design Cost	$ 3,629		
D. Total Cost (1A+1B+1C)	$ 67,749		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$67,749

2. Energy Savings (+)/Cost(-):
Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU(1)	Saving MBTU/Yr(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$12.82	18.9		$243	15.08	$3,658
B. Dist	$6.13	548.7		$3,362	18.57	$62,439
C. LPG	-	-				
D. Other	-	-				
E. Elec Demand	$102.21	0.00	kW	$0	15.08	$0
F. Total		568		$3,605		$66,096

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$0		
(1) Discount Factor (Table A)		14.88	
(2) Discounted Savings/Cost (3A x 3A1)			$0

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+) Cost(-) (4)
a.				
b.				
c.				
d. Total	$0			$0

C Total Non Energy Discounted Savings (3A2+3Bd4)	$0	
4. First Year Dollar Savings (2F3+3A+(3Bd1/Years Economic Life)):	$3,605	
5. Simple Payback (1G/4):	18.79	Years
6. Total Net Discounted Savings (2F5+3C):	$66,096	
7. Savings to Investment Ratio (SIR) 6/1G:	0.98	